Nos. 2023-1850, -2038

United States Court of Appeals
for the
Fourth Circuit

HONEYWELL INTERNATIONAL INC.; HAND HELD PRODUCTS, INC.; METROLOGIC INSTRUMENTS, INC.,

Plaintiffs-Appellants/Cross-Appellees,

v.

OPTO ELECTRONICS CO., LTD.,

Defendant-Appellee/Cross-Appellant.

On Appeal from the United States District Court for the Western District of North Carolina Case No. 3:21-cv-506-KDB-DCK

JOINT APPENDIX
VOLUME 1 OF 16 (PAGES 1-545)

Kirk T. Bradley
M. Scott Stevens
S. Benjamin Pleune
Stephen R. Lareau
Nicholas C. Marais
Lauren N. Griffin
Brandon C.E. Springer
ALSTON & BIRD LLP
Vantage South End
1120 South Tryon Street, Ste. 300
Charlotte, NC 28203
(704) 444-1000

Attorneys for Plaintiffs-Appellants Honeywell International Inc.; Hand-Held Products, Inc.; and Metrologic Instruments, Inc.

York M. Faulkner
YORKMOODYFAULKNER
711
Tensho Building, 7F
3-17-11 Shibaura
Tokyo, Minato-Ku, 108-0023
Japan
(202) 251-0837

Brian D. Schmalzbach
MCGUIREWOODS, LLP
800 East Canal Street
Richmond, Virginia 23219
(804) 775-4746

Attorneys for Defendant-Appellee Opto Electronics Co., Ltd.

April 1, 2024

APPEAL,CLOSED,FEDCIRCUIT,IAC

U.S. District Court
Western District of North Carolina (Charlotte)
CIVIL DOCKET FOR CASE #: 3:21-cv-00506-KDB-DCK

Honeywell International Inc. et al v. OPTO Electronics Co., Ltd.
Assigned to: District Judge Kenneth D. Bell
Referred to: Magistrate Judge David Keesler
Case in other court: Fourth, 23-01850
Fourth, 23-02038
Cause: 28:1332 Diversity-Other Contract

Date Filed: 09/24/2021
Date Terminated: 07/20/2023
Jury Demand: Both
Nature of Suit: 190 Contract: Other
Jurisdiction: Diversity

Plaintiff

Honeywell International Inc. represented by

Brandon C.E. Springer
Alston & Bird LLP
Vantage South End
1120 South Tryon Street
Suite 300
Charlotte, NC 28203-6818
704-444-1007
Fax: 704-444-1111
Email: brandon.springer@alston.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Lauren Nichole Griffin
Alston & Bird LLP
1120 S. Tryon Street
Suite 300
Charlotte, NC 28203-6818
704-444-1059
Fax: 704-444-1111
Email: lauren.griffin@alston.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Matthew Scott Stevens
Alston & Bird LLP
1120 South Tryon Street
Suite 300
Charlotte, NC 28203-6818
704-444-1000
Fax: 704-444-1111
Email: scott.stevens@alston.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Michael R Hoernlein

Alston & Bird LLP
Vantage South End
1120 South Tryon Street
Suite 300
Charlotte, NC 28203-6818
704-444-1041
Fax: 704-444-1111
Email: michael.hoernlein@alston.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

S. Benjamin Pleune
Alston & Bird LLP
1120 S. Tryon Street
Suite 300
Charlotte, NC 28203-6818
704-444-1098
Email: ben.pleune@alston.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Stephen Richard Lareau
Alston and Bird
101 South Tryon Street
Suite 4000
Charlotte, NC 28280
7044441083
Email: stephen.lareau@alston.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Nicholas Christopher Marais
Alston & Bird LLP
North Carolina
1120 S. Tryon Street
Ste 300
Charlotte, NC 28203
704-444-1283
Email: nic.marais@alston.com
ATTORNEY TO BE NOTICED

Mark Timothy Calloway
Alston & Bird LLP
101 S. Tryon Street
Ste. 4000
Charlotte, NC 28280
704-444-1089
Fax: 704-444-1689
Email: mark.calloway@alston.com
TERMINATED: 05/15/2023
ATTORNEY TO BE NOTICED

Plaintiff

Hand Held Products, Inc.	represented by	**Brandon C.E. Springer** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Lauren Nichole Griffin** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Matthew Scott Stevens** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Michael R Hoernlein** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **S. Benjamin Pleune** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Stephen Richard Lareau** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Nicholas Christopher Marais** (See above for address) *ATTORNEY TO BE NOTICED* **Mark Timothy Calloway** (See above for address) *TERMINATED: 05/15/2023* *ATTORNEY TO BE NOTICED*

Plaintiff

Metrologic Instruments, Inc.	represented by	**Brandon C.E. Springer** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Lauren Nichole Griffin** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Matthew Scott Stevens** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED*

Michael R Hoernlein
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

S. Benjamin Pleune
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Stephen Richard Lareau
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Nicholas Christopher Marais
(See above for address)
ATTORNEY TO BE NOTICED

Mark Timothy Calloway
(See above for address)
TERMINATED: 05/15/2023
ATTORNEY TO BE NOTICED

V.

Defendant

OPTO Electronics Co., Ltd. represented by **Christine E. Lehman**
Reichman Jorgensen Lehman & Feldberg LLP
1909 K St, NW
Suite 800
Washington, DC 20006
650-623-1401
Email: clehman@reichmanjorgensen.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Connor S. Houghton
Reichman Jorgensen Lehman & Feldberg LLP
1909 K St, NW
Suite 800
Washington, DC 20006
202-894-7315
Email: choughton@reichmanjorgensen.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Jessica Lynn O'Brien

McGuireWoods LLP
201 N. Tryon Street
Ste. 3000
Charlotte, NC 28202
704-343-2395
Email: jobrien@mcguirewoods.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Robert A. Muckenfuss
McGuireWoods LLP
P.O. Box 31247
Charlotte, NC 28231
704-343-2000
Fax: 704-343-2300
Email: rmuckenfuss@mcguirewoods.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Tyler T. VanHoutan
McGuireWoods LLP
Texas Tower
845 Texas Avenue
Ste 2400
Houston, TX 77002
832-214-9911
Email: tvanhoutan@mcguirewoods.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

York M. Faulkner
YorkMoodyFaulkner
Tensho Bldg., 7F
3-17-11 Shibaura
Ste 711
Tokyo
Japan
+12022510837
Fax: +12029723802
Email: york.faulkner@ymf-law.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Zachary L. McCamey
McGuireWoods LLP
201 N Tryon Street, Suite 3000
Charlotte, NC 28202
704-343-2070
Fax: 704-444-8870
Email: zmccamey@mcguirewoods.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Interested Party

Alston & Bird LLP represented by **S. Benjamin Pleune**
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Counter Claimant

OPTO Electronics Co., Ltd. represented by **Christine E. Lehman**
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Connor S. Houghton
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Jessica Lynn O'Brien
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Robert A. Muckenfuss
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Tyler T. VanHoutan
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

York M. Faulkner
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Zachary L. McCamey
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

V.

Counter Defendant

Hand Held Products, Inc. represented by **Brandon C.E. Springer**
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Lauren Nichole Griffin
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Matthew Scott Stevens
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Michael R Hoernlein
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

S. Benjamin Pleune
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Stephen Richard Lareau
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Nicholas Christopher Marais
(See above for address)
ATTORNEY TO BE NOTICED

Mark Timothy Calloway
(See above for address)
TERMINATED: 05/15/2023
ATTORNEY TO BE NOTICED

Counter Defendant

Honeywell International Inc. represented by **Brandon C.E. Springer**
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Lauren Nichole Griffin
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Matthew Scott Stevens
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Michael R Hoernlein
(See above for address)
LEAD ATTORNEY

ATTORNEY TO BE NOTICED

S. Benjamin Pleune
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Stephen Richard Lareau
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Nicholas Christopher Marais
(See above for address)
ATTORNEY TO BE NOTICED

Mark Timothy Calloway
(See above for address)
TERMINATED: 05/15/2023
ATTORNEY TO BE NOTICED

Counter Defendant

Metrologic Instruments, Inc. represented by **Brandon C.E. Springer**
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Lauren Nichole Griffin
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Matthew Scott Stevens
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Michael R Hoernlein
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

S. Benjamin Pleune
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Stephen Richard Lareau
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Nicholas Christopher Marais
(See above for address)

ATTORNEY TO BE NOTICED

Mark Timothy Calloway
(See above for address)
ATTORNEY TO BE NOTICED

Date Filed	#	Docket Text
09/24/2021	1	COMPLAINT against OPTO Electronics Co., Ltd. with Jury Demand (Filing fee $ 402 receipt number ANCWDC-5238104), filed by Honeywell International Inc., Metrologic Instruments, Inc., Hand Held Products, Inc.. (Attachments: # 1 Exhibit A - Public Motion to Terminate ITC Investigation, # 2 Exhibit B - L-46R Leaflet)(Calloway, Mark) (Entered: 09/24/2021)
09/27/2021		Case assigned to Senior Judge Graham Mullen. Notice: You must click this link to retrieve the **Case Assignment Packet**. *This is your only notice - you will not receive a separate document.*(dgr) (Entered: 09/27/2021)
09/27/2021	2	Summons Issued Electronically as to OPTO Electronics Co., Ltd.. **NOTICE: Counsel shall print the summons and serve with other case opening documents in accordance with Fed.R.Civ.P.4** . (dgr) (Entered: 09/27/2021)
09/30/2021	3	Corporate Disclosure Statement by Honeywell International Inc. (Griffin, Lauren) (Entered: 09/30/2021)
09/30/2021	4	Corporate Disclosure Statement by Hand Held Products, Inc. (Griffin, Lauren) (Entered: 09/30/2021)
09/30/2021	5	Corporate Disclosure Statement by Metrologic Instruments, Inc. (Griffin, Lauren) (Entered: 09/30/2021)
11/18/2021	6	AFFIDAVIT of Service filed by Honeywell International Inc., Metrologic Instruments, Inc., Hand Held Products, Inc.. OPTO Electronics Co., Ltd. served on 11/15/2021, answer due 12/6/2021. (Springer, Brandon) (Entered: 11/18/2021)
12/02/2021	7	NOTICE of Appearance by Robert A. Muckenfuss on behalf of All Defendants (Muckenfuss, Robert) (Entered: 12/02/2021)
12/02/2021	8	Consent MOTION for Extension of Time to Answer re: 1 Complaint, by OPTO Electronics Co., Ltd.. (Attachments: # 1 Proposed Order) (Muckenfuss, Robert) (Entered: 12/02/2021)
12/02/2021	9	NOTICE of Appearance by Jessica Lynn O'Brien on behalf of OPTO Electronics Co., Ltd. (O'Brien, Jessica) (Entered: 12/02/2021)
12/06/2021		**TEXT-ONLY ORDER granting 8 Motion for Extension of Time to Answer re 8 Consent MOTION for Extension of Time to Answer re: 1 Complaint, . All Defendants.. Entered by Senior Judge Graham Mullen on December 6, 2021. (DC)** (Entered: 12/06/2021)
12/07/2021	10	NOTICE of Appearance by Zachary L. McCamey on behalf of OPTO Electronics Co., Ltd. (McCamey, Zachary) (Entered: 12/07/2021)
12/13/2021	11	Corporate Disclosure Statement by OPTO Electronics Co., Ltd. (Muckenfuss, Robert) (Entered: 12/13/2021)
01/05/2022	12	Unopposed MOTION to Seal Document *(Defendant's Unopposed Motion to File Its Answer, Affirmative Defenses, and Counterclaims Under Seal)* by OPTO Electronics Co.,

		Ltd.. Responses due by 1/19/2022 (Muckenfuss, Robert) (Entered: 01/05/2022)
01/05/2022	13	MEMORANDUM in Support re 12 Unopposed MOTION to Seal Document *(Defendant's Unopposed Motion to File Its Answer, Affirmative Defenses, and Counterclaims Under Seal)* by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 01/05/2022)
01/05/2022	14	Sealed Document (*Sealed - Attorney*): Unredacted Answer, Affirmative Defenses, and Counterclaims by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Muckenfuss, Robert) Modified text on 3/20/2023 (mek). (Entered: 01/05/2022)
01/10/2022	15	**ORDER granting 12 Unopposed MOTION to Seal Document *(Defendant's Unopposed Motion to File Its Answer, Affirmative Defenses, and Counterclaims Under Seal)*. Signed by Senior Judge Graham Mullen on 1/10/2022. (ef)** (Entered: 01/10/2022)
01/20/2022	16	***Document Deleted. See notation at Doc. 17 . (maf) (Entered: 01/20/2022)
01/20/2022	17	Redacted ANSWER to 1 Complaint, with Jury Demand, filed by OPTO Electronics Co., Ltd. COUNTERCLAIM against Hand Held Products, Inc., Honeywell International Inc., and Metrologic Instruments, Inc. (NOTE: This document was previously filed at Doc. 16 under the "Redacted Document" event. The Clerk has re-filed this document using the "Answer" event for administrative purposes.) (maf) (Entered: 01/20/2022)
01/26/2022	18	Consent MOTION to Seal Document *(Honeywell's Consent Motion to File Its Memorandum in Support of Motion to Dismiss Under Seal)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 2/9/2022 (Pleune, S.) (Entered: 01/26/2022)
01/26/2022	19	MEMORANDUM in Support re 18 Consent MOTION to Seal Document *(Honeywell's Consent Motion to File Its Memorandum in Support of Motion to Dismiss Under Seal)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 01/26/2022)
01/26/2022	20	MOTION to Dismiss *Opto's Counterclaims* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 2/9/2022 (Pleune, S.) (Entered: 01/26/2022)
01/26/2022	21	Sealed Document (*Sealed - Attorney*): re: 20 MOTION to Dismiss *Opto's Counterclaims* (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Pleune, S.) (Entered: 01/26/2022)
01/27/2022	22	**ORDER granting 18 Consent MOTION to Seal Document *(Honeywell's Consent Motion to File Its Memorandum in Support of Motion to Dismiss Under Seal)*. Signed by Senior Judge Graham Mullen on 1/27/2022. (ef)** (Entered: 01/27/2022)
02/04/2022	23	REDACTION to 21 Sealed Document, *Honeywell's Memorandum in Support of its Motion to Dismiss OPTO's Counterclaims* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Pleune, S.) (Entered: 02/04/2022)
02/09/2022	24	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 20 Motion to Dismiss by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 2/16/2022 (Muckenfuss, Robert) (Entered: 02/09/2022)
02/09/2022	25	Unopposed MOTION to Seal Document 24 Sealed Response to Motion, by OPTO Electronics Co., Ltd.. Responses due by 2/23/2022 (Muckenfuss, Robert) (Entered: 02/09/2022)

02/09/2022	26	MEMORANDUM in Support re 25 Unopposed MOTION to Seal Document 24 Sealed Response to Motion, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 02/09/2022)
02/15/2022	27	**ORDER granting 25 Motion to Seal Document. Signed by Senior Judge Graham Mullen on 2/15/2022. (brl)** (Entered: 02/15/2022)
02/16/2022	28	REPLY to Response to Motion re 20 MOTION to Dismiss *Opto's Counterclaims* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Hoernlein, Michael) (Entered: 02/16/2022)
03/11/2022	29	REDACTION to 24 Sealed Response to Motion, *(Opto's Opposition to Honeywell's Motion to Dismiss Opto's Counterclaims)* by OPTO Electronics Co., Ltd. (Muckenfuss, Robert) (Entered: 03/11/2022)
03/22/2022		NOTICE of Hearing on Motion re: 20 MOTION to Dismiss *Opto's Counterclaims* : Motion Hearing set for 4/11/2022 02:00 PM in Courtroom, 401 W Trade St, Charlotte, NC 28202 before Senior Judge Graham Mullen. *This is your only notice - you will not receive a separate document.*(ef) (Entered: 03/22/2022)
04/07/2022	30	Joint MOTION for Joinder *Of the Issues and Issuance of a Scheduling Order* by OPTO Electronics Co., Ltd.. Responses due by 4/21/2022 (Muckenfuss, Robert) (Entered: 04/07/2022)
04/07/2022	31	MOTION for Leave to Appear Pro Hac Vice as to Tyler T. VanHoutan Filing fee $ 288, receipt number ANCWDC-5518699. by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit A-Court Admissions, # 2 Proposed Order) (Muckenfuss, Robert) (Entered: 04/07/2022)
04/07/2022	32	MOTION for Leave to Appear Pro Hac Vice as to York M. Faulkner Filing fee $ 288, receipt number ANCWDC-5518769. by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit A-Court Admissions, # 2 Proposed Order) (Muckenfuss, Robert) (Entered: 04/07/2022)
04/07/2022	33	MOTION for Leave to Appear Pro Hac Vice as to Christine E. Lehman Filing fee $ 288, receipt number ANCWDC-5518799. by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit A-Court Admissions, # 2 Proposed Order) (Muckenfuss, Robert) (Entered: 04/07/2022)
04/07/2022	34	MOTION for Leave to Appear Pro Hac Vice as to Connor S. Houghton Filing fee $ 288, receipt number ANCWDC-5518863. by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit A-Court Admissions, # 2 Proposed Order) (Muckenfuss, Robert) (Entered: 04/07/2022)
04/07/2022		Set/Reset Deadlines as to 20 MOTION to Dismiss *Opto's Counterclaims*. Motion Hearing set for 4/11/2022 02:00 PM in Courtroom #8, 401 W Trade St, Charlotte, NC 28202 before Senior Judge Graham Mullen. (ams) (Entered: 04/07/2022)
04/08/2022	35	**ORDER granting 31 , 32 , 33 , and 34 Motion for Leave to Appear Pro Hac Vice added Tyler T. VanHoutan,York M. Faulkner,Christine E. Lehman,Connor S. Houghton for OPTO Electronics Co., Ltd. *(Pro Hac Vice Attorney served via NEF)*. Signed by Senior Judge Graham Mullen on 4/7/2022. (ef)** (Entered: 04/08/2022)
04/08/2022		Notice to Tyler T. VanHoutan: Pursuant to Local Rule 83.1 you are required to **Register** for E-Filing Access or Link Existing Account **Link**. *(Attorney served via NEF)* Deadline by 4/15/2022. (ef) (Entered: 04/08/2022)
04/08/2022		Notice to York M. Faulkner: Pursuant to Local Rule 83.1 you are required to **Register** for E-Filing Access or Link Existing Account **Link**. *(Attorney served via NEF)* Deadline by

		4/15/2022. (ef) (Entered: 04/08/2022)
04/08/2022		Notice to Christine E. Lehman: Pursuant to Local Rule 83.1 you are required to **Register** for E-Filing Access or Link Existing Account **Link**. *(Attorney served via NEF)* Deadline by 4/15/2022. (ef) (Entered: 04/08/2022)
04/08/2022		Notice to Connor S. Houghton: Pursuant to Local Rule 83.1 you are required to **Register** for E-Filing Access or Link Existing Account **Link**. *(Attorney served via NEF)* Deadline by 4/15/2022. (ef) (Entered: 04/08/2022)
04/08/2022	36	**ORDER granting 30 Joint MOTION for Joinder Of the Issues and Issuance of a Scheduling Order. Signed by Senior Judge Graham Mullen on 4/8/2022. (ef)** (Entered: 04/08/2022)
04/11/2022		Minute Entry: MOTION HEARING held before Senior Judge Graham Mullen re 20 MOTION to Dismiss *Opto's Counterclaims*. Motion taken under advisement, order to issue. Plaintiffs attorney: Benjamin Pleune, Michael Hoernlein. Defendants attorney: Zachary McCamey, Robert Muckenfuss. Court reporter: Kathleen Cortopassi. (ams) (Entered: 04/11/2022)
04/14/2022	37	**ORDER granting in part and denying in part 20 Motion to Dismiss. Signed by Senior Judge Graham Mullen on 4/14/2022. (ef)** (Entered: 04/14/2022)
04/18/2022		SECOND Notice to Tyler T. VanHoutan: Pursuant to Local Rule 83.1 you are required to **Register** for E-Filing Access or Link Existing Account **Link**. *(Attorney served via NEF)* Deadline by 4/25/2022. (rth) (Entered: 04/18/2022)
04/28/2022	38	ANSWER to 17 Answer to Complaint,, Counterclaim, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc..(Pleune, S.) (Entered: 04/28/2022)
04/29/2022		NOTICE pursuant to Local Rule 16.1 you are **required** to conduct an Initial Attorney's Conference within 14 days. At the conference, the parties are **required** to discuss the issue of consent to jurisdiction of a magistrate judge in accordance with Local Rules 16.1(A) and 73.1(C). The **Certificate of Initial Attorneys Conference**, and if applicable, the **Joint Stipulation of Consent to Exercise jurisdiction by a US Magistrate Judge**, should be filed within 7 days of the conference. If appropriate, a party may file a Motion to Stay the Initial Attorney's Conference. CIAC Report due by 5/20/2022. (ef) (Entered: 04/29/2022)
04/29/2022	39	Joint CERTIFICATION of initial attorney conference and discovery plan (Pleune, S.) (Entered: 04/29/2022)
05/02/2022	40	**Pretrial Order and Case Management Plan: Estimated Trial Time: four (4) days. Discovery due by 9/30/2022. Motions due by 2/24/2023. Mediation deadline set for 2/3/2023. Jury Trial set for 7/17/2023 10:00 AM in Courtroom #8, 401 W Trade St, Charlotte, NC 28202 before Senior Judge Graham Mullen.. Signed by Senior Judge Graham Mullen on 5/2/2022. (ef)** (Entered: 05/02/2022)
07/15/2022	41	Consent Motion for the Issuance of a Deposition Order and Commission by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Attachments: # 1 Proposed Order)(Pleune, S.) (Additional attachment(s) added on 7/15/2022: # 2 Exhibit A) (maf). Modified on 7/15/2022 to change event type from Miscellaneous Filing to a Motion and to add Exhibit A, which was provided by email from counsel. NEF regenerated. (maf) (Entered: 07/15/2022)
07/15/2022	42	Joint MOTION for Protective Order by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/29/2022

		(Attachments: # 1 Proposed Order) (Pleune, S.) (Entered: 07/15/2022)
07/18/2022	43	**ORDER granting 41 Consent Motion for the Issuance of a Deposition Order and Commission. Signed by Senior Judge Graham Mullen on 7/18/2022. (kab)** (Entered: 07/18/2022)
07/19/2022	44	Joint MOTION for Protective Order *(Corrected)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 8/2/2022 (Attachments: # 1 Proposed Order) (Pleune, S.) (Entered: 07/19/2022)
07/20/2022	45	**ORDER granting 44 Joint Motion for Stipulated Protective Order. Signed by Senior Judge Graham Mullen on 7/20/2022. (kab)** (Entered: 07/20/2022)
09/07/2022	46	Joint MOTION for Hearing - *Telephonic Discovery Conference* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 9/21/2022 (Attachments: # 1 Ex. A - Honeywell's First RFPs to OPTO, # 2 Ex. B - OPTO's Responses and Objections, # 3 Ex. C - OPTO's Amended Responses and Objections, # 4 Ex. D - OPTO's Second Amended Responses and Objections, # 5 Ex. E - OPTO's First RFPs to Honeywell, # 6 Ex. F - Honeywell's Responses and Objections, # 7 Ex. G - Honeywell's Amended Responses and Objections) (Springer, Brandon) (Entered: 09/07/2022)
09/15/2022	47	Amended MOTION for Hearing / *Telephonic Discovery Conference [Joint Request]* by OPTO Electronics Co., Ltd.. Responses due by 9/29/2022 (Attachments: # 1 Ex. A - Honeywell First RFPs to OPTO, # 2 Ex. B - OPTO Responses and Objections, # 3 Ex. C - OPTO Am. Responses and Objections, # 4 Ex. D - OPTO Second Am. Responses and Objections, # 5 Ex. E - OPTO First RFPs to Honeywell, # 6 Ex. F - Honeywell Objections and Responses, # 7 Ex. G - Honeywell First Supp. Objections and Responses, # 8 Ex. H - Honeywell 30(b)(6) Notice, # 9 Ex. I - OPTO Second Am. Responses and Objections to 30(b)(6) Notice) (Muckenfuss, Robert) (Entered: 09/15/2022)
09/20/2022		Minute Entry: TELEPHONE DISCOVERY HEARING held before Senior Judge Graham Mullen. Attorneys' on Call: Zachary McCamey, Scott Stephens, Lauren Griffin, Robert Muckenfuss, Jessica OBrien, Tyler VanHoutan. (ef) (Entered: 09/20/2022)
10/11/2022	48	Defendant's Motion for Reimbursement of Expenses Incurred Due to Plaintiffs' Failure to Proceed with Deposition and for Protective Order. Responses due by 10/25/2022 (Attachments: # 1 Exhibit A: Email dated Sept. 29, 2022, # 2 Exhibit B: Email dated Sept. 6, 2022, # 3 Exhibit C: Declaration of Robert A. Muckenfuss) (Muckenfuss, Robert). Modified on 10/12/2022 to add motion types and to modify text, NEF regenerated (thh). (Entered: 10/11/2022)
10/12/2022	49	MOTION to Compel by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 10/26/2022 (Attachments: # 1 Exhibit A - FILED UNDER SEAL, # 2 Exhibit B - Declaration of M. Scott Stevens, # 3 Exhibit C - Plaintiffs' First Requests for Production, # 4 Exhibit D - OPTO's Responses to Requests for Production, # 5 Exhibit E - OPTO's 1st Supplemental Responses to Requests for Production, # 6 Exhibit F - OPTO's 2nd Supplemental Responses to Requests for Production, # 7 Exhibit H - Email from Z. McCarney, # 8 Exhibit I - FILED UNDER SEAL, # 9 Exhibit J - Email from R. Muckenfuss, # 10 Exhibit K - Privilege Log, # 11 Exhibit L - FILED UNDER SEAL, # 12 Exhibit M - FILED UNDER SEAL, # 13 Exhibit N - FILED UNDER SEAL) (Pleune, S.) (Entered: 10/12/2022)
10/12/2022	50	MEMORANDUM in Support re 49 MOTION to Compel *Public Version* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 10/12/2022)

10/12/2022	51	MOTION to Seal Document 50 Memorandum in Support of Motion *to File Memo iso Motion to Compel and Certain Exhibits Under Seal* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 10/26/2022 (Attachments: # 1 Exhibit 1 - SEALED Memo iso Motion to Compel, # 2 Exhibit 2 - Ex. A to Motion to Compel, # 3 Exhibit 3 - Ex. I to Motion to Compel, # 4 Exhibit 4 - Ex. L to Motion to Compel, # 5 Exhibit 5 - Ex. M to Motion to Compel, # 6 Exhibit 6 - Exhibit N to Motion to Compel) (Pleune, S.) (Entered: 10/12/2022)
10/12/2022	52	MEMORANDUM in Support re 51 MOTION to Seal Document 50 Memorandum in Support of Motion *to File Memo iso Motion to Compel and Certain Exhibits Under Seal* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 10/12/2022)
10/14/2022	53	MOTION for Hearing *Request for Second Discovery Conference* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 10/28/2022 (Attachments: # 1 Exhibit A Honeywells First Requests for Production, # 2 Exhibit B OPTOs Second Amended Objections and Responses, # 3 Exhibit C Notice of Rule 30(b)(6) deposition, # 4 Exhibit D 2d Amended R&Os to Honeywells Notice of Rule 30(b)(6), # 5 Exhibit E Honeywells Second Requests for Production, # 6 Exhibit F - OPTOs Objections and Responses, # 7 Exhibit G FRCP 30(b)(1) Notices of Deposition, # 8 Exhibit H - FRCP 30(b)(1) Notice of Deposition, # 9 Exhibit I - Email exchange) (Pleune, S.) (Entered: 10/14/2022)
10/19/2022	54	MOTION for Hearing *(Defendant's Request for Second Discovery Conference)* by OPTO Electronics Co., Ltd.. Responses due by 11/2/2022 (Attachments: # 1 Exhibit 1: OPTO's 30(b)(6) Notice of Deposition to Honeywell, # 2 Exhibit 2: Honeywell's Objections and Responses to 30(b)(6) Notice of Deposition, # 3 Exhibit 3: OPTO's Second Set of Requests for Production, # 4 Exhibit 4: OPTO's Second Set of Interrogatories, # 5 Exhibit 5: Honeywell's Objections and Responses to OPTO's Second Set of Interrogatories, # 6 Exhibit 6: Honeywell's Objections and Responses to OPTO's Second Set of Requests for Production, # 7 Exhibit 7: E-mail from S. Stevens, 9/20/2022, # 8 Exhibit 8: E-mail from T. VanHoutan, 9/20/2022, # 9 Exhibit 9: E-mail from M. Connor, 10/13/2022) (Muckenfuss, Robert) (Entered: 10/19/2022)
10/25/2022	55	MEMORANDUM in Opposition re 48 Defendant's Motion for Reimbursement of Expenses Incurred Due to Plaintiffs' Failure to Proceed with Deposition and for Protective Order. by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 11/1/2022 (Attachments: # 1 Exhibit A - Declaration of M. Scott Stevens, # 2 Exhibit B - 4/11/22 email, # 3 Exhibit C - 4/12/22 email, # 4 Exhibit D - 5/2/22 Notice of Rule 30(b)(6) Deposition to OPTO, # 5 Exhibit E - 5/23/22 email, # 6 Exhibit F - 5/25/22 email, # 7 Exhibit G - 6/1/22 email, # 8 Exhibit H - 6/14/22 email, # 9 Exhibit I - 6/20/22 email, # 10 Exhibit J - 6/21/22 email, # 11 Exhibit K - 6/24/22 email, # 12 Exhibit L - 7/18/22 email, # 13 Exhibit M - 7/1/22 email, # 14 Exhibit N - 7/6/22 email, # 15 Exhibit O - 7/7/22 email, # 16 Exhibit P - 7/14/22 email, # 17 Exhibit Q - 9/13/22 email, # 18 Exhibit R - 5/2/22 Honeywell First Set of Requests for Production, # 19 Exhibit S - 9/6/22 email, # 20 Exhibit T - 9/9/22 email, # 21 Exhibit U - 9/20/22 email (1/3), # 22 Exhibit V - 9/20/22 email (2/3), # 23 Exhibit W - 9/20/22 email (3/3), # 24 Exhibit X - 9/21/22 Whitley Deposition excerpt, # 25 Exhibit Y - 9/21/22 email, # 26 Exhibit Z - 9/23/22 email, # 27 Exhibit AA - 9/30/22 email, # 28 Exhibit BB - 9/28/22 letter, # 29 Exhibit CC - 9/28/22 email, # 30 Exhibit DD - 10/5/22 email)(Pleune, S.) (Entered: 10/25/2022)
10/26/2022	56	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 49 Motion to Compel,,, by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 11/2/2022 (Attachments: # 1 Exhibit A: Honeywells First Set of Requests for

		Production of Documents, # 2 Exhibit B: OPTOs First Set of Requests for Production of Documents, # 3 Exhibit C: OPTOs Responses and Objections to Plaintiffs First Requests for Production of Documents, # 4 Exhibit D: OPTOs Second Amended Responses and Objections to Plaintiffs First Requests for Production of Documents, # 5 Exhibit E: Honeywells First Supplemental Objections and Responses to Defendants First Set of Requests for Production of Documents, # 6 Exhibit F: E-mail thread dated September 23, 2022, # 7 Exhibit G: Excerpts of Yoshiaki Kohmo Deposition, # 8 Exhibit H: E-mail thread dated September 7, 2022, # 9 Exhibit I: Expert Report of Craig Smith) (Muckenfuss, Robert) (Entered: 10/26/2022)
10/26/2022	57	RESPONSE in Opposition re 49 MOTION to Compel *(Redacted, Public Version)* by OPTO Electronics Co., Ltd.. Replies due by 11/2/2022 (Attachments: # 1 Exhibit A: Honeywells First Set of Requests for Production of Documents, # 2 Exhibit B: OPTOs First Set of Requests for Production of Documents, # 3 Exhibit C: OPTOs Responses and Objections to Plaintiffs First Requests for Production of Documents, # 4 Exhibit D: OPTOs Second Amended Responses and Objections to Plaintiffs First Requests for Production of Documents, # 5 Exhibit E: Honeywells First Supplemental Objections and Responses to Defendants First Set of Requests for Production of Documents, # 6 Exhibit F: E-mail thread dated September 23, 2022, # 7 Exhibit G: Filed Under Seal, # 8 Exhibit H: E-mail thread dated September 7, 2022, # 9 Exhibit I: Filed Under Seal)(Muckenfuss, Robert) (Entered: 10/26/2022)
10/26/2022	58	MOTION to Seal Document 56 Sealed Response to Motion,,,, by OPTO Electronics Co., Ltd.. Responses due by 11/9/2022 (Muckenfuss, Robert) (Entered: 10/26/2022)
10/26/2022	59	MEMORANDUM in Support re 58 MOTION to Seal Document 56 Sealed Response to Motion,,,, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 10/26/2022)
11/01/2022	60	MOTION for Extension of Time (Defendant's Motion for Extension of Expert Discovery Deadlines) by OPTO Electronics Co., Ltd.. Responses due by 11/15/2022 (Attachments: # 1 Proposed Order) (Muckenfuss, Robert) (Entered: 11/01/2022)
11/01/2022	61	REPLY to Response to Motion re 48 Defendant's Motion for Reimbursement of Expenses Incurred Due to Plaintiffs' Failure to Proceed with Deposition and for Protective Order. by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 11/01/2022)
11/02/2022	62	RESPONSE to Motion re 54 MOTION for Hearing *(Defendant's Request for Second Discovery Conference)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 11/9/2022 (Attachments: # 1 Exhibit A - 10/13/2022 email)(Pleune, S.) (Entered: 11/02/2022)
11/02/2022	63	SEALED REPLY *(Sealed - Attorney)* to Response to Motion re: 49 Motion to Compel,,, (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.) (Pleune, S.) (Entered: 11/02/2022)
11/02/2022	64	Consent MOTION to Seal Document 63 Sealed Reply to Response to Motion *to Compel* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 11/16/2022 (Pleune, S.) (Entered: 11/02/2022)
11/02/2022	65	MEMORANDUM in Support re 64 Consent MOTION to Seal Document 63 Sealed Reply to Response to Motion *to Compel* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 11/02/2022)
11/02/2022	66	REPLY to Response to Motion re 49 MOTION to Compel - *REDACTED PUBLIC VERSION* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 11/02/2022)

11/04/2022	67	MEMORANDUM in Opposition re 60 MOTION for Extension of Time (Defendant's Motion for Extension of Expert Discovery Deadlines) by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 11/14/2022 (Attachments: # 1 Exhibit A - email string re M&C, # 2 Exhibit B - email string re source code, # 3 Exhibit C - package notification, # 4 Exhibit D - Fed Ex tracking)(Pleune, S.) (Entered: 11/04/2022)
11/07/2022		Added Magistrate Judge David Keesler. (ef) (Entered: 11/07/2022)
11/07/2022	68	REPLY to Response to Motion re 60 MOTION for Extension of Time (Defendant's Motion for Extension of Expert Discovery Deadlines) by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 11/07/2022)
11/07/2022	69	**ORDER REFERRING MOTION: 53 MOTION for Hearing *Request for Second Discovery Conference*, 51 MOTION to Seal Document 50 Memorandum in Support of Motion *to File Memo iso Motion to Compel and Certain Exhibits Under Seal*, 47 Amended MOTION for Hearing / *Telephonic Discovery Conference [Joint Request]*, 60 MOTION for Extension of Time (Defendant's Motion for Extension of Expert Discovery Deadlines) , 54 MOTION for Hearing *(Defendant's Request for Second Discovery Conference)*, 49 MOTION to Compel , 46 Joint MOTION for Hearing - *Telephonic Discovery Conference*, 64 Consent MOTION to Seal Document 63 Sealed Reply to Response to Motion *to Compel*. Signed by Senior Judge Graham Mullen on 11/7/2022. (ef)Motions referred to David Keesler.** (Entered: 11/07/2022)
11/07/2022		Motion referred to David Keesler per order document 69: 51 MOTION to Seal Document 50 Memorandum in Support of Motion *to File Memo iso Motion to Compel and Certain Exhibits Under Seal*, 58 MOTION to Seal Document 56 Sealed Response to Motion, , 42 Joint MOTION for Protective Order , 48 Defendant's Motion for Reimbursement of Expenses Incurred Due to Plaintiffs' Failure to Proceed with Deposition and for Protective Order. (ef) (Entered: 11/07/2022)
11/07/2022	70	Exhibits by OPTO Electronics Co., Ltd. Attachment to 68 Reply to Response to Motion (Attachments: # 1 Exhibit A: E-mail Chain (October 12, 2022), # 2 Exhibit B: Discovery Conference E-mail Thread)(Muckenfuss, Robert) Modified text on 11/8/2022 (kab). (Entered: 11/07/2022)
11/07/2022	71	SEALED REPLY *(Sealed - Attorney)* to Response to Motion re: 54 Motion for Hearing,,, by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A: E-mail 1002, # 2 Exhibit B. E-mail 1040, # 3 Exhibit C: E-mail 1003, # 4 Exhibit D: E-mail 1061, # 5 Exhibit E: Honeywell-00268758) (Muckenfuss, Robert) (Entered: 11/07/2022)
11/07/2022	72	REPLY to Response to Motion re 54 MOTION for Hearing *(Defendant's Request for Second Discovery Conference) - Public/Redacted Version* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit A: E-mail 1002 (filed under seal), # 2 Exhibit B: E-mail 1040 (filed under seal), # 3 Exhibit C: E-mail 1003 (filed under seal), # 4 Exhibit D: E-mail 1061 (filed under seal), # 5 Exhibit E: Honeywell-00268758)(Muckenfuss, Robert) (Entered: 11/07/2022)
11/07/2022	73	Unopposed MOTION to Seal Document 71 Sealed Reply to Response to Motion, by OPTO Electronics Co., Ltd.. Responses due by 11/21/2022 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 11/07/2022)
11/07/2022	74	MEMORANDUM in Support re 73 Unopposed MOTION to Seal Document 71 Sealed Reply to Response to Motion, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 11/07/2022)

11/21/2022	75	Sealed Document (*Sealed - Attorney*): Defendant's Supplement to its Request for Second Discovery Conference re: 54 MOTION for Hearing *(Defendant's Request for Second Discovery Conference)* by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A: Privilege Log)(Muckenfuss, Robert) (Entered: 11/21/2022)
11/21/2022	76	Supplemental Memorandum by OPTO Electronics Co., Ltd. as to 54 MOTION for Hearing *(Defendant's Request for Second Discovery Conference)* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit A: Exhibit Filed Under Seal (Privilege Log)) (Muckenfuss, Robert) (Entered: 11/21/2022)
11/21/2022	77	Unopposed MOTION to Seal Document 75 Sealed Document, *(Defendant's Unopposed Motion to File Portions of its Supplement to Request for Second Discovery Conference Under Seal)* by OPTO Electronics Co., Ltd.. Responses due by 12/5/2022 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 11/21/2022)
11/21/2022	78	MEMORANDUM in Support re 77 Unopposed MOTION to Seal Document 75 Sealed Document, *(Defendant's Unopposed Motion to File Portions of its Supplement to Request for Second Discovery Conference Under Seal)* by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 11/21/2022)
11/22/2022	79	NOTICE *of of Supplemental Exhibits* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. re 49 MOTION to Compel (Attachments: # 1 Exhibit O - 9/26/22 email string (redacted), # 2 Exhibit P - 9/28/22 email string (redacted))(Pleune, S.) (Entered: 11/22/2022)
11/22/2022	80	Sealed Document (*Sealed - Attorney*): Supplemental Ex. O to Motion to Compel (Dkt. 49) by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Pleune, S.) (Entered: 11/22/2022)
11/22/2022	81	Sealed Document (*Sealed - Attorney*): Supplemental Ex. P to Motion to Compel (Dkt. 49) by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Pleune, S.) (Entered: 11/22/2022)
11/22/2022	82	MOTION to Seal Document 80 Sealed Document, 81 Sealed Document, *re Supplemental Exhibits to Motion to Compel 49* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 12/6/2022 (Pleune, S.). Motions referred to David Keesler. (Entered: 11/22/2022)
11/22/2022	83	MEMORANDUM in Support re 82 MOTION to Seal Document 80 Sealed Document, 81 Sealed Document, *re Supplemental Exhibits to Motion to Compel 49* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 11/22/2022)
12/05/2022	84	RESPONSE in Opposition re 54 MOTION for Hearing *(Defendant's Request for Second Discovery Conference) (REDACTED PUBLIC VERSION)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 12/12/2022 (Attachments: # 1 Exhibit Declaration of S. Benjamin Pleune FILED UNDER SEAL, # 2 Exhibit A - CPA Registration, # 3 Exhibit B - FILED UNDER SEAL, # 4 Exhibit C - FILED UNDER SEAL, # 5 Exhibit D - FILED UNDER SEAL, # 6 Exhibit E - 5/13/22 Honeywell's Initial Disclosures, # 7 Exhibit F - 5/13/22 OPTO's Initial Disclosures, # 8 Exhibit G - FILED UNDER SEAL, # 9 Exhibit H - FILED UNDER SEAL, # 10 Exhibit I - FILED UNDER SEAL, # 11 Exhibit J - Excerpts from 2021 OPTO securities report, #

		12 Exhibit K - 9/20/22 email re Honeywell's 10th Document Production, # 13 Exhibit L - 10/26/22 email re Whitley deposition)(Pleune, S.) (Entered: 12/05/2022)
12/05/2022	85	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 54 Motion for Hearing,,, by Hand Held Products, Inc.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 12/12/2022 (Attachments: # 1 Exhibit Declaration of S. Benjamin Pleune, # 2 Exhibit B - OPTO NDA, # 3 Exhibit C - 12/16/20 letter, # 4 Exhibit D - 5/21/21 letter, # 5 Exhibit G - 11/18/22 Adams Report, # 6 Exhibit H - 12/17/20 email, # 7 Exhibit I - 12/19/20 email)(Pleune, S.) (Entered: 12/05/2022)
12/05/2022	86	Consent MOTION to Seal Document 85 Sealed Response to Motion,, *Declaration of S. Benjamin Pleune & Exs. B, C, D, G, H & I* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 12/19/2022 (Pleune, S.). Motions referred to David Keesler. (Entered: 12/05/2022)
12/05/2022	87	MEMORANDUM in Support re 86 Consent MOTION to Seal Document 85 Sealed Response to Motion,, *Declaration of S. Benjamin Pleune & Exs. B, C, D, G, H & I* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 12/05/2022)
12/09/2022	88	SEALED REPLY *(Sealed - Attorney)* to Response to Motion re: 54 Motion for Hearing,,, by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A: ITC Protective Order)(Muckenfuss, Robert) (Entered: 12/09/2022)
12/09/2022	89	REPLY to Response to Motion re 54 MOTION for Hearing *(Defendant's Request for Second Discovery Conference)* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit A: ITC Protective Order)(Muckenfuss, Robert) (Entered: 12/09/2022)
12/09/2022	90	Unopposed MOTION to Seal Document 88 Sealed Reply to Response to Motion, by OPTO Electronics Co., Ltd.. Responses due by 12/27/2022 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 12/09/2022)
12/09/2022	91	MEMORANDUM in Support re 90 Unopposed MOTION to Seal Document 88 Sealed Reply to Response to Motion, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 12/09/2022)
12/16/2022	92	**ORDER granting 51 Motion to Seal Document No 50 Memorandum in Support of Motion *to File Memo iso Motion to Compel and Certain Exhibits Under Seal*, 58 MOTION to Seal Document 56 Sealed Response to Motion, 64 Consent MOTION to Seal Document 63 Sealed Reply to Response to Motion *to Compel*, 73 Unopposed MOTION to Seal Document 71 Sealed Reply to Response to Motion, 77 Unopposed MOTION to Seal Document 75 Sealed Document, *(Defendant's Unopposed Motion to File Portions of its Supplement to Request for Second Discovery Conference Under Seal)*, 82 MOTION to Seal Document 80 Sealed Document, 81 Sealed Document, *re Supplemental Exhibits to Motion to Compel 49* , 86 Consent MOTION to Seal Document 85 Sealed Response to Motion, *Declaration of S. Benjamin Pleune & Exs. B, C, D, G, H & I*, 90 Unopposed MOTION to Seal Document 88 Sealed Reply to Response to Motion. Signed by Magistrate Judge David Keesler on 12/16/22. (mga)** (Entered: 12/16/2022)
12/19/2022	93	**ORDER denying without prejudice 48 Defendant' s Motion for Protective Order and Motion for Reimbursement of Expenses; denying without prejudice 49 Plaintiff's Motion to Compel; granting with modification 53 Plaintiff's Request for Second Discovery Conference; granting with modification 54 Defendant's Motion for Hearing; granting with modification 60 Defendant's Motion for Extension of**

		Expert Discovery Deadlines Status Report due by 1/13/2023. Status Hearing/Discovery Conference set for 1/24/2023. The case deadlines are STAYED until otherwise ordered by the Court. Signed by Magistrate Judge David Keesler on 12/16/22. (mga) (Entered: 12/19/2022)
12/19/2022		NOTICE of Hearing: Status Conference/Discovery Conference set for 1/24/2023 10:00 AM in Courtroom #1A, 401 W Trade St, Charlotte, NC 28202 before Magistrate Judge David Keesler. *This is your only notice - you will not receive a separate document.*(mga) (Entered: 12/19/2022)
12/30/2022	94	Exhibit by OPTO Electronics Co., Ltd.. Exhibit to 56 Sealed Response to Motion,,,, *Exhibit G: Excerpts of Yoshiaki Kohmo Deposition (Public Version)* (Muckenfuss, Robert) (Entered: 12/30/2022)
12/30/2022	95	Exhibit by OPTO Electronics Co., Ltd.. Exhibit to 56 Sealed Response to Motion,,,, *Exhibit I: Expert Report of Craig Smith (Public Version)* (Muckenfuss, Robert) (Entered: 12/30/2022)
12/30/2022	96	Exhibit by OPTO Electronics Co., Ltd.. Exhibit to 71 Sealed Reply to Response to Motion, *Public Versions of Exhibit A (E-mail 1002), Exhibit B (E-mail 1040), Exhibit C (E-mail 1003), and Exhibit D (E-mail 1061)* (Muckenfuss, Robert) (Entered: 12/30/2022)
12/30/2022	97	Exhibit by OPTO Electronics Co., Ltd.. Exhibit to 75 Sealed Document, *Exhibit A: Privilege Log (Public Version)* (Muckenfuss, Robert) (Entered: 12/30/2022)
12/30/2022	98	Exhibit by Honeywell International Inc.. Exhibit to 51 Motion to Seal Document,, - *Ex. A to Motion to Compel (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	99	Exhibit by Honeywell International Inc.. Exhibit to 51 Motion to Seal Document,, - *Ex. I to Motion to Compel (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	100	Exhibit by Honeywell International Inc.. Exhibit to 51 Motion to Seal Document,, - *Ex. L to Motion to Compel (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	101	Exhibit by Honeywell International Inc.. Exhibit to 51 Motion to Seal Document,, - *Ex. M to Motion to Compel (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	102	Exhibit by Honeywell International Inc.. Exhibit to 51 Motion to Seal Document,, - *Ex. N to Motion to Compel (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	103	Exhibit by Honeywell International Inc.. Exhibit to 80 Sealed Document, - *Supplemental Ex. O to Motion to Compel (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	104	Exhibit by Honeywell International Inc.. Exhibit to 81 Sealed Document, - *Supplemental Ex. P to Motion to Compel (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	105	Exhibit by Honeywell International Inc.. Exhibit to 85 Sealed Response to Motion,, - *Ex. B - OPTO NDA (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	106	Exhibit by Honeywell International Inc.. Exhibit to 85 Sealed Response to Motion,, - *Ex. C - 12/16/20 letter (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	107	Exhibit by Honeywell International Inc.. Exhibit to 85 Sealed Response to Motion,, - *Ex. D - 5/21/21 letter (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	108	Exhibit by Honeywell International Inc.. Exhibit to 85 Sealed Response to Motion,, - *Ex. G - 11/18/22 Adams Report (public version)* (Pleune, S.) (Entered: 12/30/2022)
12/30/2022	109	Exhibit by Honeywell International Inc.. Exhibit to 85 Sealed Response to Motion,, - *Ex. H - 12/17/20 email (public version)* (Pleune, S.) (Entered: 12/30/2022)

12/30/2022	110	Exhibit by Honeywell International Inc.. Exhibit to 85 Sealed Response to Motion,, - *Ex. I - 12/19/20 email (public version)* (Pleune, S.) (Entered: 12/30/2022)
01/13/2023	111	STATUS REPORT *(Joint Status Report)* by OPTO Electronics Co., Ltd. (Muckenfuss, Robert) (Entered: 01/13/2023)
01/20/2023	112	**ORDER that the parties shall file a revised Joint Status Report, as directed herein, on or before January 30, 2023. The Status Hearing/Discovery Conference scheduled for January 24, 2023, is CANCELLED The Status Hearing/Discovery Conference is RESCHEDULED for 2/15/2023 10:00 AM in Courtroom #1A, 401 W Trade St, Charlotte, NC 28202 before Magistrate Judge David Keesler. Signed by Magistrate Judge David Keesler on 1/19/23. (mga)** (Entered: 01/20/2023)
01/20/2023		Set Deadlines/Hearings: Status Report due by 1/30/2023 (mga) (Entered: 01/20/2023)
01/26/2023	113	**ORDER OF RECUSAL re: Conflict of Interest. The Clerk is directed to reassign this case to another judge. Signed by Senior Judge Graham Mullen on 1/26/2023. (kab)** (Entered: 01/26/2023)
01/26/2023		Case reassigned to District Judge Kenneth D. Bell. Senior Judge Graham Mullen no longer assigned to the case. *This is your only notice - you will not receive a separate document.*(kab) (Entered: 01/26/2023)
01/30/2023	114	STATUS REPORT *(Amended Joint Status Report)* by OPTO Electronics Co., Ltd. (Muckenfuss, Robert) (Entered: 01/30/2023)
02/15/2023		Minute Entry: Status Conference/Discovery Hearing held before Magistrate Judge David Keesler. Plaintiffs attorney: Matthew Scott Stevens, S. Benjamin Pleune, and Mark Timothy Calloway. Defendants attorney: Robert A. Muckenfuss and Jessica Lynn O'Brien. Court reporter: Debra Cohen-Rojas. (mga) (Entered: 02/15/2023)
02/16/2023	115	**ORDER granting in part and denying in part discovery disputes identified in 114 Amended Joint Status Report. Signed by Magistrate Judge David Keesler on 2/16/23. (mga)** (Entered: 02/16/2023)
02/22/2023	116	MOTION for Partial Summary Judgment *and Legal Determinations Regarding Contractual Interpretation* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 3/8/2023 (Springer, Brandon) (Entered: 02/22/2023)
02/22/2023	117	MEMORANDUM in Support re 116 MOTION for Partial Summary Judgment *and Legal Determinations Regarding Contractual Interpretation* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit Exhibit Index, # 2 Exhibit A - 1/22/2020 License & Settlement Agreement, # 3 Exhibit B - 7/1/2019 Correspondence, # 4 Exhibit C - MDL-2001 Product Specifications, # 5 Exhibit D - 9/21/2022 J. Whitley Deposition Excerpts, # 6 Exhibit E - 9/29/2022 Supplemental Responses to First Set of Interrogatories, # 7 Exhibit F - 9/29/2022 Objections to Second Set of Interrogatories, # 8 Exhibit G - 11/18/2022 G. Adams Expert Report Excerpts)(Springer, Brandon) (Entered: 02/22/2023)
02/22/2023	118	Sealed Document (*Sealed - Attorney*): Memo in Support of Motion for Partial Summary Judgment and Legal Determinations Regarding Contractual Interpretation by Honeywell International Inc.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit Exhibit Index, # 2 Exhibit A - 1/22/2020 License & Settlement Agreement, # 3 Exhibit B - 7/1/2019 Correspondence, # 4 Exhibit D - 9/21/2022 J. Whitley Deposition Excerpts, # 5 Exhibit E - 9/29/2022 Supplemental Responses to First Set of Interrogatories, # 6

		Exhibit F - 9/29/2022 Objections to Second Set of Interrogatories, # 7 Exhibit G - 11/18/2022 G. Adams Expert Report Excerpts)(Springer, Brandon) (Entered: 02/22/2023)
02/22/2023	119	Consent MOTION to Seal Document 118 Sealed Document,,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 3/8/2023 (Springer, Brandon). Motions referred to David Keesler. (Entered: 02/22/2023)
02/22/2023	120	MEMORANDUM in Support re 119 Consent MOTION to Seal Document 118 Sealed Document,,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Springer, Brandon) (Entered: 02/22/2023)
02/23/2023	121	**ORDER granting 119 Honeywell's Consent Motion to File Its Motion for Partial Summary Judgment and Corresponding Exhibits Under Seal. Signed by Magistrate Judge David Keesler on 2/23/23. (mga)** (Entered: 02/23/2023)
02/25/2023	122	TRANSCRIPT of discovery motions and status conference held on 2/15/2023 before Judge David Keesler. **NOTICE RE: REDACTION OF TRANSCRIPTS: The parties have 5 business days to file a *Notice of Intent to Request Redaction* and 21 calendar days to file a *Redaction Request*. If no notice is filed, this transcript will be made electronically available to the public without redaction after 90 calendar days. Transcript may be viewed at the court public terminal or purchased through the court reporter before the 90 day deadline. After that date it may be obtained through PACER. Policy at www.ncwd.uscourts.gov** Release of Transcript Restriction set for 5/23/2023. (Reporter: Deborah Cohen-Rojas, 704-350-7400) (Entered: 02/25/2023)
02/27/2023	123	NOTICE *of Compliance* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. re 115 Order (Pleune, S.) (Entered: 02/27/2023)
03/02/2023	124	Sealed Document (*Sealed - Attorney*): Defendant's Objections to Magistrate Judge Keesler's Order on Discovery Disputes re: 115 Order by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A: Tanaka Deposition Excerpts, # 2 Exhibit B: E-mails, # 3 Exhibit C: Honeywell Responses to Requests for Admission Excerpts)(Muckenfuss, Robert) (Entered: 03/02/2023)
03/02/2023	125	Objection to Magistrate Judge's Decision (Rule 72(a)) re 115 Order *(Public Version)*. Responses due by 3/16/2023 (Attachments: # 1 Exhibit A: Filed Under Seal (Tanaka Depo Excerpts), # 2 Exhibit B: Filed Under Seal (E-mails), # 3 Exhibit C: Filed Under Seal (Honeywell Responses to RFA Excerpts))(Muckenfuss, Robert) Modified access on 3/6/2023 (mga). (Entered: 03/02/2023)
03/02/2023	126	Consent MOTION to Seal Document 124 Sealed Document, *Objections to Magistrate Judge Keesler's Order on Discovery Disputes* by OPTO Electronics Co., Ltd.. Responses due by 3/16/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 03/02/2023)
03/02/2023	127	MEMORANDUM in Support re 126 Consent MOTION to Seal Document 124 Sealed Document, *Objections to Magistrate Judge Keesler's Order on Discovery Disputes* by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 03/02/2023)
03/03/2023	128	NOTICE to Court Reporter Deborah Cohen-Rojas of Intent to Request Redaction of 122 Transcript,,, by Robert A. Muckenfuss (Muckenfuss, Robert) (Entered: 03/03/2023)
03/03/2023	129	Joint Proposal Regarding Revised Case Deadlines by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Springer, Brandon) Modified text on 3/6/2023 (mek). (Entered: 03/03/2023)

03/06/2023	130	**ORDER granting 126 Defendant's Consent Motion to Seal Document No. 125 and its attachments shall remain under SEAL until otherwise ordered by this Court. Signed by Magistrate Judge David Keesler on 3/3/23. (mga)** (Main Document 130 replaced on 3/6/2023) (mga). NEF regenerated on 3/6/2023 (mga). (Entered: 03/06/2023)
03/06/2023	131	**Joint Revised Pretrial Order and Case Management Plan: Discovery due by 3/10/2023. Motions due by 3/29/2023. Mediator Designation deadline set for 3/31/2023. Mediation deadline set for 5/5/2023. Jury Trial set for 7/17/2023 09:30 AM in Courtroom #4B, 401 W Trade St, Charlotte, NC 28202 before District Judge Kenneth D. Bell. Signed by Magistrate Judge David Keesler on 3/6/23. (mga) (Entered: 03/06/2023)**
03/08/2023	132	MOTION for Summary Judgment by OPTO Electronics Co., Ltd.. Responses due by 3/22/2023 (Muckenfuss, Robert) (Entered: 03/08/2023)
03/08/2023	133	Sealed Document (*Sealed - Attorney*): Defendant's Memorandum in Support of Its Motion for Summary Judgment re: 132 MOTION for Summary Judgment (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Exhibit 5)(Muckenfuss, Robert) (Entered: 03/08/2023)
03/08/2023	134	MEMORANDUM in Support re 132 MOTION for Summary Judgment *(Public Version)* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Exhibit 5)(Muckenfuss, Robert) (Entered: 03/08/2023)
03/08/2023	135	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 116 Motion for Partial Summary Judgment by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 3/15/2023 (Attachments: # 1 Exhibit 1: ITC Complaint, # 2 Exhibit 2: ITC Order, # 3 Exhibit 3: ITC Order and Honeywell's Response, # 4 Exhibit 4: Claim Chart Excerpts, # 5 Exhibit 5: ISO/IEC 15415, # 6 Exhibit 6: Honeywell Website, # 7 Exhibit 7: Symbol Tech '655 Patent, # 8 Exhibit 8: ISO/IEC 15438, # 9 Exhibit 9: Accurate Data, # 10 Exhibit 10: Honeywell Tech Support Page)(Muckenfuss, Robert) (Main Document 135 replaced on 3/9/2023) (clc). (Entered: 03/08/2023)
03/08/2023	136	RESPONSE in Opposition re 116 MOTION for Partial Summary Judgment *and Legal Determinations Regarding Contractual Interpretation* by OPTO Electronics Co., Ltd.. Replies due by 3/15/2023 (Attachments: # 1 Exhibit 1: ITC Complaint, # 2 Exhibit 2: ITC Order, # 3 Exhibit 3: ITC Order and Honeywell's Response, # 4 Exhibit 4: Claim Chart Excerpts, # 5 Exhibit 5: ISO/IEC 15415, # 6 Exhibit 6: Honeywell Website, # 7 Exhibit 7: Symbol Tech '655 Patent, # 8 Exhibit 8: ISO/IEC 15438, # 9 Exhibit 9: Accurate Data, # 10 Exhibit 10: Honeywell Tech Support Page)(Muckenfuss, Robert) (Main Document 136 replaced on 3/9/2023) (clc). (Entered: 03/08/2023)
03/08/2023	137	MOTION to Strike *(Daubert Motion to Exclude Testimony of David O. Taylor)* by OPTO Electronics Co., Ltd.. Responses due by 3/22/2023 (Muckenfuss, Robert) (Entered: 03/08/2023)
03/08/2023	138	Sealed Document (*Sealed - Attorney*): Defendant's Memorandum in Support of Its Daubert Motion to Exclude Testimony of David O. Taylor re: 137 MOTION to Strike *(Daubert Motion to Exclude Testimony of David O. Taylor)* by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit 1: Expert Report of David O. Taylor, # 2 Exhibit 2: Rebuttal Report of David O. Taylor, # 3 Exhibit 3: David O. Taylor Deposition Excerpts)(Muckenfuss, Robert) (Entered: 03/08/2023)

03/08/2023	139	MEMORANDUM in Support re 137 MOTION to Strike *(Daubert Motion to Exclude Testimony of David O. Taylor)* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1: Expert Report of David O. Taylor (filed under seal), # 2 Exhibit 2: Rebuttal Report of David O. Taylor (filed under seal), # 3 Exhibit 3: David O. Taylor Deposition Excerpts (filed under seal))(Muckenfuss, Robert) (Entered: 03/08/2023)
03/08/2023	140	MOTION to Seal Document 138 Sealed Document,, 135 Sealed Response to Motion,, 133 Sealed Document, by OPTO Electronics Co., Ltd.. Responses due by 3/22/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 03/08/2023)
03/08/2023	141	MEMORANDUM in Support re 140 MOTION to Seal Document 138 Sealed Document,, 135 Sealed Response to Motion,, 133 Sealed Document, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 03/08/2023)
03/10/2023	142	**ORDER granting 140 Defendant's Consent Motion to Seal Document Nos. 133,135,138,133-1,133-2,133-4,133-5,138-1,138-2, and 138-3. Defendant shall file publicly available, redacted versions of its briefs (Document Nos. 133,135, and 138) on or before March 14, 2023. Signed by Magistrate Judge David Keesler on 3/10/23. (mga)** (Entered: 03/10/2023)
03/10/2023		Set/Reset Deadlines: Redacted briefs due by 3/14/2023. (mga) (Entered: 03/10/2023)
03/14/2023		NOTICE of Hearing on Motions re: 116 MOTION for Partial Summary Judgment *and Legal Determinations Regarding Contractual Interpretation,* 132 MOTION for Summary Judgment and 137 MOTION to Strike *(Daubert Motion to Exclude Testimony of David O. Taylor)*: Motions Hearing set for 4/13/2023 01:30 PM in Courtroom #4B, 401 W Trade St, Charlotte, NC 28202 before District Judge Kenneth D. Bell. *This is your only notice - you will not receive a separate document.*(mek) Modified text on 3/21/2023 (mek). (Entered: 03/14/2023)
03/15/2023	143	REPLY to Response to Motion re 116 MOTION for Partial Summary Judgment *and Legal Determinations Regarding Contractual Interpretation* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit A - 9/29/2022 Defendant's Supplemental & Amended Objections & Responses to Plaintiffs' First Set of Interrogatories, # 2 Exhibit B - International Standard ISO/IEC 15438, # 3 Exhibit C - 9/27/2022 Excerpts from Deposition of Yoshiaki Kohmo, # 4 Exhibit D - 10/21/2022 Expert Report of Dr. Ynjiun Paul Wang, # 5 Exhibit E - Product Description Sheet for Opticon MDI-4050/4150 2D CMOS Imager)(Springer, Brandon) (Entered: 03/15/2023)
03/15/2023	144	SEALED REPLY *(Sealed - Attorney)* to Response to Motion re: 116 Motion for Partial Summary Judgment by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit Index, # 2 Exhibit A - 9/29/2022 Defendant's Supplemental & Amended Objections & Responses to Plaintiffs' First Set of Interrogatories, # 3 Exhibit B - International Standard ISO/IEC 15438, # 4 Exhibit C - 9/27/2022 Experts from Deposition of Yoshiaki Kohmo)(Springer, Brandon) (Entered: 03/15/2023)
03/15/2023	145	Consent MOTION to Seal Document 144 Sealed Reply to Response to Motion,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 3/29/2023 (Springer, Brandon). Motions referred to David Keesler. (Entered: 03/15/2023)
03/15/2023	146	MEMORANDUM in Support re 145 Consent MOTION to Seal Document 144 Sealed Reply to Response to Motion,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Springer, Brandon) (Entered: 03/15/2023)

03/16/2023	147	**ORDER granting 145 Honeywell's Consent Motion to Seal Document Nos. 144, 144-2, 144-3, and 144-4. Plaintiff's redacted version f its Reply due March 20, 2023. Signed by Magistrate Judge David Keesler on 3/16/23. (mga)** (Entered: 03/16/2023)
03/16/2023	148	RESPONSE re 124 Sealed Document, 125 Objection to Magistrate Judge's Decision (Rule 72(a)) re 115 Order *(Public Version)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit A - 9/6/2022 email, # 2 Exhibit B - 8/30/2022 Honeywell's Second Set of Requests for Production of Documents, # 3 Exhibit C - 2/24/2022 Independent Auditor's Report & Internal Control Audit Report, # 4 Exhibit D - 12/18/2020 email chain (HONEYWELL-002700371-74), # 5 Exhibit E - 5/7/2021 email chain (HONEYWELL-00271115-17))(Springer, Brandon) (Entered: 03/16/2023)
03/16/2023	149	Sealed Document (*Sealed - Attorney*): Response to Defendant's Objections to Magistrate Judge's Order on Discovery Dispute (Dkt. 124) re: 148 Response,, by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit Index of Sealed Exhibits, # 2 Exhibit D - 12/18/2020 email chain (HONEYWELL-002700371-74), # 3 Exhibit E - 5/7/2021 email chain (HONEYWELL-002711115-17))(Springer, Brandon) (Entered: 03/16/2023)
03/16/2023	150	Consent MOTION to Seal Document 149 Sealed Document,, *Response to Defendant's Objections to Magistrate Judge Keesler's Order on Discovery Issues* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 3/30/2023 (Springer, Brandon). Motions referred to David Keesler. (Entered: 03/16/2023)
03/16/2023	151	MEMORANDUM in Support re 150 Consent MOTION to Seal Document 149 Sealed Document,, *Response to Defendant's Objections to Magistrate Judge Keesler's Order on Discovery Issues* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Springer, Brandon) (Entered: 03/16/2023)
03/17/2023	152	**ORDER granting 150 Honeywell's Consent Motion to Seal Document 149 Response to Defendant's Objections to Magistrate Judge Keesler's Order on Discovery Issues. Plaintiff shall file a publicly available, redacted version of its sealed filing on or before March 21, 2023. Signed by Magistrate Judge David Keesler on 3/16/23. (mga)** (Entered: 03/17/2023)
03/17/2023		**TEXT-ONLY ORDER: For the avoidance of doubt, the Parties are directed to make no further filings either in support or in opposition to Defendant's Objection to Magistrate Judge's Decision (Doc. No. 125). So Ordered. Entered by District Judge Kenneth D. Bell on 3/17/2023. (mek)** (Entered: 03/17/2023)
03/20/2023	153	Transcript Redaction Request *(Sealed - Participants)* to Court Reporter Deborah Cohen-Rojas re 122 Transcript by attorney Robert A. Muckenfuss (Attachments: # 1 Exhibit A: Redacted Hearing Transcript)(Muckenfuss, Robert) (Entered: 03/20/2023)
03/21/2023	154	**ORDER denying Defendant's 125 Objection to Magistrate Judge's Decision (Rule 72(a)) re No. 115 Order; and affirming 115 Order Granting in Part and Denying in Part Discovery Disputes, to the extent described in this Order. Signed by District Judge Kenneth D. Bell on 3/21/2023. (mek)** (Entered: 03/21/2023)
03/22/2023	155	RESPONSE in Opposition re 137 MOTION to Strike *(Daubert Motion to Exclude Testimony of David O. Taylor)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 3/29/2023 (Attachments: # 1 Index of Exhibits to Honeywell's Response in Opposition to OPTO's Daubert Motion, # 2 Exhibit A - Mobile Telecommunications Order, # 3 Exhibit B - Certain Smart Thermostats Order,

		# 4 Exhibit C - Certain Smart Thermostats Transcript (excerpts), # 5 Exhibit D - Taylor Deposition Transcript (excerpts))(Pleune, S.) (Entered: 03/22/2023)
03/22/2023	156	RESPONSE in Opposition re 132 MOTION for Summary Judgment *(Redacted)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 3/29/2023 (Attachments: # 1 Index of Publicly Filed Exhibits to Honeywell's Response in Opposition to OPTO's Motion for Summary Judgment, # 2 Exhibit A - Current Marketing Materials, # 3 Exhibit B - OPTO Patent, # 4 Exhibit C - Expert Report of Ryan N. Herrington (Redacted))(Pleune, S.) (Entered: 03/22/2023)
03/22/2023	157	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 132 Motion for Summary Judgment by Hand Held Products, Inc., Honeywell International, Inc. and Metrologic Instruments, Inc.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 3/29/2023 (Attachments: # 1 Index of Sealed Exhibit to Honeywell's Response in Opposition to OPTO's Motion for Summary Judgment, # 2 Exhibit C - Expert Report of Ryan N. Herrington)(Pleune, S.) (Entered: 03/22/2023)
03/22/2023	158	Consent MOTION to Seal Document 157 Sealed Response to Motion,, *and 157-2, Exhibit C* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 4/5/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 03/22/2023)
03/22/2023	159	MEMORANDUM in Support re 158 Consent MOTION to Seal Document 157 Sealed Response to Motion,, *and 157-2, Exhibit C* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 03/22/2023)
03/23/2023	160	**ORDER granting 158 Honeywell's Consent Motion to Seal Document 157 Sealed Response to Motion, *and 157-2, Exhibit C*. Signed by Magistrate Judge David Keesler on 3/23/2023. (kab)** (Entered: 03/23/2023)
03/28/2023	161	MOTION for Summary Judgment *(Partial) Rejecting Opto's Patent Misuse Affirmative Defense and Counterclaim* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 4/11/2023 (Pleune, S.) (Entered: 03/28/2023)
03/28/2023	162	MEMORANDUM in Support re 161 MOTION for Summary Judgment *(Partial) Rejecting Opto's Patent Misuse Affirmative Defense and Counterclaim* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit Exhibit List for Public/Redacted Exhibits, # 2 Exhibit A - License and Settlement Agreement, # 3 Exhibit B - Second Amendment to License and Settlement Agreement, # 4 Exhibit C - 7/1/19 correspondence from Pleune to Chu, # 5 Exhibit D - Def.'s Supplemental and Amended Objections and Responses to Pl's First Set of Interrogatories)(Pleune, S.) (Entered: 03/28/2023)
03/28/2023	163	Sealed Document (*Sealed - Attorney*): Sealed Memo and Exhibits iso Motion for Partial Summary Judgment Rejecting Opto's Patent Misuse Affirmative Defense and Counterclaim re: 162 Memorandum in Support of Motion,, by Honeywell International Inc.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit Exhibit List for Sealed Exhibits, # 2 Exhibit A - License and Settlement Agreement, # 3 Exhibit B - Second Amendment to License and Settlement Agreement, # 4 Exhibit C - 7/1/19 correspondence from Pleune to Chu, # 5 Exhibit D - Def.'s Supplemental and Amended Objections and Responses to Pl's First Set of Interrogatories)(Pleune, S.) (Entered: 03/28/2023)
03/28/2023	164	Consent MOTION to Seal Document 163 Sealed Document,,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by

		4/11/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 03/28/2023)
03/28/2023	165	MEMORANDUM in Support re 164 Consent MOTION to Seal Document 163 Sealed Document,,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 03/28/2023)
03/29/2023	166	REPLY to Response to Motion re 132 MOTION for Summary Judgment by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 03/29/2023)
03/29/2023	167	REPLY to Response to Motion re 137 MOTION to Strike *(Daubert Motion to Exclude Testimony of David O. Taylor)* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit 4: Taylor Deposition Excerpts)(Muckenfuss, Robert) (Entered: 03/29/2023)
03/29/2023	168	MOTION for Summary Judgment *Regarding Plaintiffs' Patent Misuse* by OPTO Electronics Co., Ltd.. Responses due by 4/12/2023 (Muckenfuss, Robert) (Entered: 03/29/2023)
03/29/2023	169	Sealed Document (*Sealed - Attorney*): Defendant's Memorandum in Support re: 168 MOTION for Summary Judgment *Regarding Plaintiffs' Patent Misuse* by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit 1: Honeywell's First Amended Objections and Responses to Defendant's First Interrogatories, # 2 Exhibit 2: '783 Patent)(Muckenfuss, Robert) (Entered: 03/29/2023)
03/29/2023	170	MEMORANDUM in Support re 168 MOTION for Summary Judgment *Regarding Plaintiffs' Patent Misuse (Redacted, Public Version)* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1: Honeywell's First Amended Objections and Responses to Defendant's First Interrogatories (filed under seal), # 2 Exhibit 2: '783 Patent) (Muckenfuss, Robert) (Entered: 03/29/2023)
03/29/2023	171	MOTION to Seal Document 169 Sealed Document,, by OPTO Electronics Co., Ltd.. Responses due by 4/12/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 03/29/2023)
03/29/2023	172	MEMORANDUM in Support re 171 MOTION to Seal Document 169 Sealed Document,, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 03/29/2023)
03/29/2023	173	MOTION to Strike *and Exclude the Expert Testimony of Greg Adams* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 4/12/2023 (Attachments: # 1 Proposed Order) (Pleune, S.) (Entered: 03/29/2023)
03/29/2023	174	MEMORANDUM in Support re 173 MOTION to Strike *and Exclude the Expert Testimony of Greg Adams* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 List of Redacted/Public Exhibits to Honeywell's Motion to Strike and Exclude the Expert Testimony of Greg Adams, # 2 Exhibit A Expert Report of Greg Adams, # 3 Exhibit B Honeywell's First Set of Requests for Production of Documents, # 4 Exhibit C Honeywell's Second Set of Requests for Production of Documents, # 5 Exhibit D OPTO_00011837)(Pleune, S.) (Entered: 03/29/2023)
03/29/2023	175	Sealed Document (*Sealed - Attorney*): Sealed Memorandum in Support of Honeywell's Motion to Strike and Exclude the Expert Testimony of Greg Adams re: 174 Memorandum in Support of Motion,, by Plaintiffs; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 List of Sealed Exhibits to Honeywell's Motion to Strike and Exclude the Expert Testimony of Greg Adams, # 2 Exhibit A Expert Report of Greg Adams, # 3 Exhibit D OPTO_00011837)(Pleune, S.) (Entered: 03/29/2023)

03/29/2023	176	Consent MOTION to Seal Document 175 Sealed Document,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 4/12/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 03/29/2023)
03/29/2023	177	MEMORANDUM in Support re 176 Consent MOTION to Seal Document 175 Sealed Document,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 03/29/2023)
03/30/2023	178	**ORDER granting 164 Honeywell's Consent Motion to File Under Seal. Document Nos. 163, 163-2, 163-3, 163-4, and 163-5. Redacted version due 4/3/2023. Signed by Magistrate Judge David Keesler on 3/29/23. (mga)** (Entered: 03/30/2023)
03/30/2023		**TEXT-ONLY ORDER: To permit the Court to address all the pending motions at the hearing scheduled for April 13, 2023, the Parties are ORDERED to file their respective responses to Plaintiffs' Motion for Summary Judgment (Partial), Doc. No. 161; Defendant's Motion for Summary Judgment Regarding Patent Misuse, Doc. No. 168; and Plaintiffs' Motion to Strike and Exclude Expert Testimony of Greg Adams, Doc. No. 175, on or before April 10, 2023. No replies are permitted with respect to these motions, as the Parties will have an opportunity to reply at the hearing. So Ordered. Entered by District Judge Kenneth D. Bell on 3/30/2023. (mek)** (Entered: 03/30/2023)
03/31/2023	179	**ORDER granting 171 Defendant's Consent Motion to File its Motion for Summary Judgment Regarding Plaintiffs' Patent Misused Under Seal. Document Nos. 169 and 169-1 shall remain under SEAL until otherwise ordered by this Court. Signed by Magistrate Judge David Keesler on 3/30/23. (mga)** (Entered: 03/31/2023)
03/31/2023	180	**ORDER granting 176 Honeywell's Consent Motion to Seal Document Document Nos. 175, 175-2, and 175-3. Signed by Magistrate Judge David Keesler on 3/30/23. (mga)** (Entered: 03/31/2023)
03/31/2023	181	DESIGNATION of Ray Owens as Mediator by all the parties. (Pleune, S.) Modified text on 4/3/2023 (mek). (Entered: 03/31/2023)
04/03/2023	182	NOTICE of Appearance by Nicholas Christopher Marais on behalf of Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Marais, Nicholas) (Entered: 04/03/2023)
04/10/2023	183	MEMORANDUM in Opposition re 168 MOTION for Summary Judgment *Regarding Plaintiffs' Patent Misuse* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 4/17/2023 (Attachments: # 1 Exhibit A - 9/30/2022 Honeywell's First Amended Objections & Responses to First Set of Interrogatories)(Pleune, S.) (Entered: 04/10/2023)
04/10/2023	184	Sealed Document (*Sealed - Attorney*): Sealed Opposition to Motion for Summary Judgment re Patent Misuse re: 168 MOTION for Summary Judgment *Regarding Plaintiffs' Patent Misuse* by Honeywell International Inc.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A - 9/30/2022 Honeywell's First Amended Objections & Responses to First Set of Interrogatories)(Pleune, S.) (Entered: 04/10/2023)
04/10/2023	185	Consent MOTION to Seal Document 184 Sealed Document,, *re Opposition to Motion for Summary Judgment re Patent Misuse* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 4/24/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 04/10/2023)

04/10/2023	186	MEMORANDUM in Support re 185 Consent MOTION to Seal Document 184 Sealed Document,, *re Opposition to Motion for Summary Judgment re Patent Misuse* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 04/10/2023)
04/10/2023	187	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 161 Motion for Summary Judgment, by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 4/17/2023 (Attachments: # 1 Exhibit A: OPTO's Supplemental Responses to Plaintiffs' First Set of Interrogatories (Filed Under Seal))(Muckenfuss, Robert) (Entered: 04/10/2023)
04/10/2023	188	MEMORANDUM in Opposition re 161 MOTION for Summary Judgment *(Partial) Rejecting Opto's Patent Misuse Affirmative Defense and Counterclaim (Public, Redacted Version)* by OPTO Electronics Co., Ltd.. Replies due by 4/17/2023 (Attachments: # 1 Exhibit A: OPTO's Supplemental Responses to Plaintiffs' First Set of Interrogatories (Filed Under Seal))(Muckenfuss, Robert) (Entered: 04/10/2023)
04/10/2023	189	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 173 Motion to Strike by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 4/17/2023 (Attachments: # 1 Exhibit 1: Expert Report of Dr. Greg Adams (Filed Under Seal), # 2 Exhibit 2: 2020 Global & U.S. Auto ID Market Assessment (OPTO_00011887), # 3 Exhibit 3: 2022 Global & U.S. Auto ID Market Assessment (OPTO_00014124), # 4 Exhibit 4: : OPTO Sales Information Spreadsheet (OPTO_00011846, Filed Under Seal), # 5 Exhibit 5: OPTO Sales Information Spreadsheet (OPTO_00007085, Filed Under Seal), # 6 Exhibit 6: Expert Report of Ryan N. Herrington (Filed Under Seal))(Muckenfuss, Robert) (Entered: 04/10/2023)
04/10/2023	190	MEMORANDUM in Opposition re 173 MOTION to Strike *and Exclude the Expert Testimony of Greg Adams (Public, Redacted Version)* by OPTO Electronics Co., Ltd.. Replies due by 4/17/2023 (Attachments: # 1 Exhibit 1: Expert Report of Dr. Greg Adams (Filed Under Seal), # 2 Exhibit 2: 2020 Global & U.S. Auto ID Market Assessment (OPTO_00011887), # 3 Exhibit 3: 2022 Global & U.S. Auto ID Market Assessment (OPTO_00014124), # 4 Exhibit 4: : OPTO Sales Information Spreadsheet (OPTO_00011846, Filed Under Seal), # 5 Exhibit 5: OPTO Sales Information Spreadsheet (OPTO_00007085, Filed Under Seal), # 6 Exhibit 6: Expert Report of Ryan N. Herrington (Filed Under Seal))(Muckenfuss, Robert) (Entered: 04/10/2023)
04/10/2023	191	Consent MOTION to Seal Document 189 Sealed Response to Motion,,, 187 Sealed Response to Motion, by OPTO Electronics Co., Ltd.. Responses due by 4/24/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 04/10/2023)
04/10/2023	192	MEMORANDUM in Support re 191 Consent MOTION to Seal Document 189 Sealed Response to Motion,,, 187 Sealed Response to Motion, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 04/10/2023)
04/11/2023	193	**ORDER granting 185 Motion to Seal Document. Document Nos. 184 and 184-1 shall remain under SEAL until otherwise ordered by this Court. IT IS FURTHER ORDERED that Honeywell shall file a publicly available redacted version of its response in opposition to Defendants summary judgment motion on or before April 17, 2023. Signed by US Magistrate Judge David Keesler on 4/11/2023. (brl)** (Entered: 04/11/2023)
04/11/2023	194	**ORDER granting 191 Motion to Seal Document. Document Nos. 187, 187-1, 189, 189-1, 189-4, 189-5, and 189-6 shall remain under SEAL until otherwise ordered by**

		this Court. Signed by US Magistrate Judge David Keesler on 4/11/2023. (brl) (Entered: 04/11/2023)
04/13/2023		Minute Entry: MOTION HEARING held before District Judge Kenneth D. Bell. Re: 116 MOTION for Partial Summary Judgment *and Legal Determinations Regarding Contractual Interpretation*, 132 MOTION for Summary Judgment , 137 MOTION to Strike *(Daubert Motion to Exclude Testimony of David O. Taylor)*, 161 MOTION for Summary Judgment *(Partial) Rejecting Opto's Patent Misuse Affirmative Defense and Counterclaim*, 168 MOTION for Summary Judgment *Regarding Plaintiffs' Patent Misuse*, 173 MOTION to Strike *and Exclude the Expert Testimony of Greg Adams*. Motion taken under advisement, order to issue. Plaintiffs attorney: S. Benjamin Pleune, Matthew Scott Stevens. Defendants attorney: Robert A. Muckenfuss, Tyler T. VanHoutan, York M. Faulkner, Zachary L. McCamey, Jessica Lynn O'Brien. Court reporter: Jillian Turner. (mek) (Entered: 04/13/2023)
04/20/2023	195	**ORDER: Plaintiffs' 116 Motion for Partial Summary Judgment is GRANTED as to the construction of Section 1.4 of the Agreement but DENIED as to their claims under Section 5.1. Summary judgment is entered in favor of Defendant on Plaintiffs' Section 5.1 breach of representation and warranty claim; Defendant's 132 Motion for Summary Judgment is DENIED, except as described in the Order; the parties' 161 and 168 cross Motions for Summary Judgment are DENIED; Defendant's 137 Motion to Strike is GRANTED to the extent described in the Order; Plaintiffs' 173 Motion to Strike is DENIED; Defendant's 115 and 125 Objections to Issues 6 and 8 of the Magistrate Judge's ruling on discovery disputes are ALLOWED as described in the Order; and the case shall proceed to trial on the merits of the remaining claims in the absence of a voluntary resolution of the dispute among the parties. Signed by District Judge Kenneth D. Bell on 4/20/2023. (mek)** (Entered: 04/20/2023)
05/01/2023	196	MOTION for Reconsideration *of Dkt. 195 and Offer of Proof* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 5/15/2023 (Pleune, S.). Modified on 5/2/2023 to remove referral (mek). (Entered: 05/01/2023)
05/01/2023	197	Sealed Document (*Sealed - Attorney*): Memorandum in Support of Motion for Reconsideration re: 196 MOTION for Reconsideration *of Dkt. 195 and Offer of Proof* by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit Index of Sealed Exhibits, # 2 Exhibit A - License and Settlement Agreement, # 3 Exhibit B - Pl's First Amended Objections & Responses to Def's First Set of Interrogatories, # 4 Exhibit C - Expert Report of Ryan N. Herrington, # 5 Exhibit D - 9/8/2020 letter to OPTO, # 6 Exhibit E - 9/16/2020 email from Counsel for OPTO, # 7 Exhibit F - 10/23/2020 email from Counsel for OPTO, # 8 Exhibit G - 12/16/2020 letter to Counsel for OPTO, # 9 Exhibit H - 1/1/2021 email from Counsel for OPTO, # 10 Exhibit I - Non-Disclosure & Confidentiality Agreement, # 11 Exhibit J - 1/4/2021 email from Matsuzawa, # 12 Exhibit K - 1/6/2021 email from Matsuzawa, # 13 Exhibit L - 1/11/2021 email to Matsuzawa, # 14 Exhibit M - 1/15/2021 email to Matsuzawa, # 15 Exhibit N - 1/26/2021 email from Matsuzawa, # 16 Exhibit O - 2/1 & 2/10/2021 emails to Matsuzawa, # 17 Exhibit P - 2/3/2021 email to Matsuzawa, # 18 Exhibit Q - 3/31/2021 email to Matsuzawa, # 19 Exhibit R - Deposition Transcript of Rie Ashihara)(Pleune, S.) (Entered: 05/01/2023)
05/01/2023	198	MEMORANDUM in Support re 196 MOTION for Reconsideration *of Dkt. 195 and Offer of Proof (PUBLIC/UNREDACTED VERSION* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit Index of Public Exhibits, # 2 Exhibit A - License & Settlement Agreement, # 3 Exhibit B - Pls' First Amended Objections & Responses to Def's First Set of Interrogatories, # 4 Exhibit C

		- Expert Report of Ryan N. Herrington, # 5 Exhibit D - 9/8/2020 letter to OPTO, # 6 Exhibit E - 9/16/2020 email from Counsel for OPTO, # 7 Exhibit F - 10/23/2020 email from Counsel for OPTO, # 8 Exhibit G - 12/16/2020 letter to Counsel for OPTO, # 9 Exhibit H - 1/1/2021 email from Counsel for OPTO, # 10 Exhibit I - Non-Disclosure & Confidentiality Agreement, # 11 Exhibit J - 1/4/2021 email from Matsuzawa, # 12 Exhibit K - 1/6/2021 email from Matsuzawa, # 13 Exhibit L - 1/11/2021 email to Matsuzawa, # 14 Exhibit M - 1/15/2021 email to Matsuzawa, # 15 Exhibit N - 1/26/2021 email to Matsuzawa, # 16 Exhibit O - 2/1 & 2/10/2021 emails to Matsuzawa, # 17 Exhibit P - 3/3/2021 email to Matsuzawa, # 18 Exhibit Q - 3/31/2021 email to Matsuzawa, # 19 Exhibit R - Deposition Transcript of Rie Ashihara, # 20 Exhibit S - OPTO Electronics Audit Report (Translation and Certification))(Pleune, S.) (Entered: 05/02/2023)
05/02/2023	199	Consent MOTION to Seal Document 197 Sealed Document by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. Responses due by 5/16/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 05/02/2023)
05/02/2023	200	MEMORANDUM in Support re 199 Consent MOTION to Seal Document 197 Sealed Document,,,,, *re Memo iso Reconsideration* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 05/02/2023)
05/02/2023	201	**ORDER granting 199 Honeywell's Consent Motion to Seal. Document No. 197 and its attachments shall remain under SEAL until otherwise ordered by this Court. Signed by US Magistrate Judge David Keesler on 5/2/23. (mga)** (Entered: 05/02/2023)
05/05/2023	202	Joint MOTION for Extension of Time to Complete Mediation by OPTO Electronics Co., Ltd.. Responses due by 5/19/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 05/05/2023)
05/08/2023	203	**ORDER granting 202 parties Joint Motion for Extension of Time of Scheduling Order Deadlines. Mediation Report due on or before June 15, 2023. Signed by US Magistrate Judge David Keesler on 5/8/23. (mga)** (Entered: 05/08/2023)
05/10/2023	204	TRANSCRIPT of Motions Hearing held on 4/13/2023 before Judge Kenneth D. Bell. **NOTICE RE: REDACTION OF TRANSCRIPTS: The parties have 5 business days to file a *Notice of Intent to Request Redaction* and 21 calendar days to file a *Redaction Request*. If no notice is filed, this transcript will be made electronically available to the public without redaction after 90 calendar days. Transcript may be viewed at the court public terminal or purchased through the court reporter before the 90 day deadline. After that date it may be obtained through PACER. Policy at www.ncwd.uscourts.gov** Release of Transcript Restriction set for 8/7/2023. (Reporter: Jill Turner, 704-350-7495) (Entered: 05/10/2023)
05/11/2023	205	MOTION to Withdraw as Attorney - *Mark Calloway* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 5/25/2023 (Attachments: # 1 Proposed Order) (Calloway, Mark). Motions referred to David Keesler. (Entered: 05/11/2023)
05/12/2023	206	NOTICE *of Filing Supplemental Exhibits* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. re 197 Sealed Document (Attachments: # 1 Exhibit J - 1/4/2021 email from Matsuzawa, # 2 Exhibit K - 1/6/2021 email from Matsuzawa, # 3 Exhibit L - 1/11/2021 email to Matsuzawa, # 4 Exhibit M - 1/15/2021 email to Matsuzawa, # 5 Exhibit N - 1/26/2021 email from Matsuzawa, # 6 Exhibit O - 2/1 & 2/10/2021 emails to Matsuzawa, # 7 Exhibit P - 2/3/2021 email to Matsuzawa, # 8 Exhibit Q - 3/31/2021 email to Matsuzawa, # 9 Exhibit S - Motions Hearing Transcript) (Pleune, S.) (Entered: 05/12/2023)
05/12/2023	207	Sealed Document (*Sealed - Attorney*): Supplemental Exhibits J-Q and Exhibit S re: 197 Sealed Document, (available to Hand Held Products, Inc., Honeywell International Inc.,

		Metrologic Instruments, Inc.) (Attachments: # 1 Exhibit Suppl J - 1/4/2021 email from Matsuzawa, # 2 Exhibit Suppl K - 1/6/2021 email from Matsuzawa, # 3 Exhibit Suppl L - 1/11/2021 email to Matsuzawa, # 4 Exhibit Suppl M - 1/15/2021 email to Matsuzawa, # 5 Exhibit Suppl N - 1/26/2021 email from Matsuzawa, # 6 Exhibit Suppl O - 2/1 & 2/10/2021 emails to Matsuzawa, # 7 Exhibit Suppl P - 2/3/2021 email to Matsuzawa, # 8 Exhibit Suppl Q - 3/31/2021 email to Matsuzawa, # 9 Exhibit S - 4-13-23 Motions Hearing Transcript)(Pleune, S.) Modified text on 5/12/2023 (clc). (Entered: 05/12/2023)
05/15/2023	208	**ORDER granting 205 Attorney Mark T. Calloway's Motion to Withdraw as Attorney. Attorney Mark Timothy Calloway terminated. Signed by US Magistrate Judge David Keesler on 5/15/23. (mga)** (Entered: 05/15/2023)
05/15/2023	209	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 196 Motion for Reconsideration (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 5/22/2023 (Muckenfuss, Robert) (Entered: 05/15/2023)
05/15/2023	210	RESPONSE in Opposition re 196 MOTION for Reconsideration *of Dkt. 195 and Offer of Proof (Public Version)* by OPTO Electronics Co., Ltd.. Replies due by 5/22/2023 (Muckenfuss, Robert) (Entered: 05/15/2023)
05/15/2023	211	Unopposed MOTION to Seal Document 209 Sealed Response to Motion, by OPTO Electronics Co., Ltd.. Responses due by 5/30/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 05/15/2023)
05/15/2023	212	MEMORANDUM in Support re 211 Unopposed MOTION to Seal Document 209 Sealed Response to Motion, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 05/15/2023)
05/16/2023	213	**ORDER granting 211 Defendant's Unopposed Motion to Seal Document No. 209 and Exhibit A. Signed by US Magistrate Judge David Keesler on 5/16/23. (mga)** (Entered: 05/16/2023)
05/16/2023	214	Joint NOTICE of Intent to Request Redaction of 204 Transcript,, by Robert A. Muckenfuss (Muckenfuss, Robert) (Entered: 05/16/2023)
05/22/2023	215	Sealed Document (*Sealed - Attorney*): Reply in Support of Motion for Reconsideration and Offer of Proof re: 196 MOTION for Reconsideration *of Dkt. 195 and Offer of Proof* by Honeywell International Inc.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Pleune, S.) (Entered: 05/22/2023)
05/22/2023	216	Consent MOTION to Seal Document 215 Sealed Document, *Reply in Support of Motion for Reconsideration* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 6/5/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 05/22/2023)
05/22/2023	217	MEMORANDUM in Support re 216 Consent MOTION to Seal Document 215 Sealed Document, *Reply in Support of Motion for Reconsideration* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 05/22/2023)
05/22/2023	218	Redacted REPLY to Response to Motion re 196 MOTION for Reconsideration *of Dkt. 195 and Offer of Proof PUBLIC VERSION* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 05/22/2023)
05/23/2023	219	**ORDER granting 216 Plaintiff's Consent Motion to Seal Document No. 215. Signed by US Magistrate Judge David Keesler on 5/23/23. (mga)** (Entered: 05/23/2023)

05/31/2023	220	Transcript Redaction Request *(Sealed - Participants)* to Court Reporter Jillian M. Turner re 204 Transcript,, by attorney Robert A. Muckenfuss (Attachments: # 1 Exhibit A - Requested redactions)(Muckenfuss, Robert) (Entered: 05/31/2023)
06/01/2023	221	Joint MOTION to Take Deposition from Paul Chartier by OPTO Electronics Co., Ltd.. Responses due by 6/15/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 06/01/2023)
06/01/2023	222	**ORDER granting 221 Joint Motion to Conduct De Bene Esse Deposition of Mr. Chartier. Signed by US Magistrate Judge David Keesler on 6/1/23. (mga)** (Entered: 06/01/2023)
06/02/2023	223	**ORDER denying Plaintiffs' 196 Motion for Reconsideration of the Court's 195 Order. This case shall proceed to trial on the merits of the remaining claims in this action (and only those claims) in the absence of a voluntary resolution of the dispute among the parties. Signed by District Judge Kenneth D. Bell on 6/2/2023. (mek)** (Entered: 06/02/2023)
06/06/2023	224	REPORT of Mediation. Outcome of Mediation: Parties reached an Impasse. (Owens, Raymond) (Entered: 06/06/2023)
06/12/2023	225	NOTICE of Certificate of Settlement Conference Pursuant to Standing Order 5:19-mc-5. Result: Unable to resolve. (Pleune, S.) (Entered: 06/12/2023)
06/14/2023	226	MOTION for Protective Order *Regarding Deposition of Naohide Kamio* by OPTO Electronics Co., Ltd.. Responses due by 6/28/2023 (Muckenfuss, Robert). Modified on 6/15/2023 to remove referral (mek). (Entered: 06/14/2023)
06/14/2023	227	Sealed Document (*Sealed - Attorney*): OPTO Electronics Co., Ltd.'s Brief in Support of Its Motion for Protective Order Regarding Deposition of Naohide Kamio re: 226 MOTION for Protective Order *Regarding Deposition of Naohide Kamio* by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit s 1 - 5 (filed with public version Brief), # 2 Exhibit 6: Filed Under Seal)(Muckenfuss, Robert) (Entered: 06/14/2023)
06/14/2023	228	MEMORANDUM in Support re 226 MOTION for Protective Order *Regarding Deposition of Naohide Kamio (Public Version)* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1: April 10, 2023 Email, # 2 Exhibit 2: April 14, 2023 Email, # 3 Exhibit 3: May 18, 2023 Email (1), # 4 Exhibit 4: May 18, 2023 Email (2), # 5 Exhibit 5: May 25, 2023 Letter, # 6 Exhibit 6: Filed Under Seal)(Muckenfuss, Robert) (Entered: 06/14/2023)
06/14/2023	229	Consent MOTION to Seal Document 227 Sealed Document,, by OPTO Electronics Co., Ltd.. Responses due by 6/28/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 06/14/2023)
06/14/2023	230	MEMORANDUM in Support re 229 Consent MOTION to Seal Document 227 Sealed Document,, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 06/14/2023)
06/16/2023	231	**ORDER granting 229 Defendant's Consent Motion to Seal Document No. 227 and 227-2. Redacted version of Document No. 227 due June 20, 2023. Signed by US Magistrate Judge David Keesler on 6/15/23. (mga)** Modified text on 6/16/2023 (mga). (Entered: 06/16/2023)
06/20/2023	232	Joint STIPULATION *of Facts* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Pleune, S.) (Entered: 06/20/2023)

06/20/2023	233	MOTION in Limine *Honeywell's First Motion In Limine to Exclude Testimony or Argument About Information Learned Solely from Communications Between OPTO and Its Counsel* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/5/2023 (Pleune, S.) (Entered: 06/20/2023)
06/20/2023	234	Sealed Document (*Sealed - Attorney*): Memorandum in Support of Honeywell's First Motion in Limine re: 233 MOTION in Limine *Honeywell's First Motion In Limine to Exclude Testimony or Argument About Information Learned Solely from Communications Between OPTO and Its Counsel* by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A - 2/15/2023 Status Hearing Transcript (excerpted), # 2 Exhibit B - 9/28/2022 Deposition Transcript of Shigeaki Tanaka (excerpted))(Pleune, S.) (Entered: 06/20/2023)
06/20/2023	235	MEMORANDUM in Support re 233 MOTION in Limine *Honeywell's First Motion In Limine to Exclude Testimony or Argument About Information Learned Solely from Communications Between OPTO and Its Counsel (REDACTED PUBLIC VERSION)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit A - 2/15/2023 Status Hearing Transcript (excerpted) (redacted), # 2 Exhibit B - 9/28/2022 Deposition Transcript of Shigeaki Tanaka (Filed Under Seal in its Entirety))(Pleune, S.) (Entered: 06/20/2023)
06/20/2023	236	MOTION to Seal Document 234 Sealed Document,, *Honeywell's Memorandum in Support of its First Motion in Limine* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/5/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 06/20/2023)
06/20/2023	237	MEMORANDUM in Support re 236 MOTION to Seal Document 234 Sealed Document,, *Honeywell's Memorandum in Support of its First Motion in Limine* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 06/20/2023)
06/20/2023	238	Second MOTION in Limine *Honeywell's Second Motion in Limine to Exclude Evidence or Argument About the Interpretation of "2D Barcode Products" or "1D Barcode Products"* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/5/2023 (Pleune, S.) (Entered: 06/20/2023)
06/20/2023	239	Second MOTION in Limine *CORRECTED Second Motion in Limine to Exclude Evidence or Argument About the Interpretation of "2D Barcode Products" or "1D Barcode Products"* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/5/2023 (Pleune, S.) (Entered: 06/20/2023)
06/20/2023	240	Sealed Document (*Sealed - Attorney*): Memorandum in Support of Honeywell's Second Motion in Limine re: 239 Second MOTION in Limine *CORRECTED Second Motion in Limine to Exclude Evidence or Argument About the Interpretation of "2D Barcode Products" or "1D Barcode Products"* by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A - 6/1/2023 Deposition Transcript of Ronny De Winter (excerpted))(Pleune, S.) (Entered: 06/20/2023)
06/20/2023	241	MEMORANDUM in Support re 239 Second MOTION in Limine *CORRECTED Second Motion in Limine to Exclude Evidence or Argument About the Interpretation of "2D Barcode Products" or "1D Barcode Products" (REDACTED PUBLIC VERSION)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit A - 6/1/2023 Deposition Transcript of Ronny De Winter (Filed Under Seal in its Entirety))(Pleune, S.) (Entered: 06/20/2023)

06/20/2023	242	MOTION to Seal Document 240 Sealed Document,, *Honeywell's Memorandum in Support of its Second Motion in Limine* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/5/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 06/20/2023)
06/20/2023	243	MEMORANDUM in Support re 242 MOTION to Seal Document 240 Sealed Document,, *Honeywell's Memorandum in Support of its Second Motion in Limine* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 06/20/2023)
06/20/2023	244	Third MOTION in Limine *Honeywell's Third Motion in Limine to Exclude Evidence or Argument Regarding Honeywell's Infringement Contentions from the ITC Investigation* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/5/2023 (Pleune, S.) (Entered: 06/20/2023)
06/20/2023	245	Sealed Document (*Sealed - Attorney*): Memorandum in Support of Honeywell's Third Motion in Limine re: 244 Third MOTION in Limine *Honeywell's Third Motion in Limine to Exclude Evidence or Argument Regarding Honeywell's Infringement Contentions from the ITC Investigation* by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit D - 6/7/2023 Deposition Transcript of Craig M. Smith (excerpted))(Pleune, S.) (Entered: 06/20/2023)
06/20/2023	246	MEMORANDUM in Support re 244 Third MOTION in Limine *Honeywell's Third Motion in Limine to Exclude Evidence or Argument Regarding Honeywell's Infringement Contentions from the ITC Investigation (REDACTED PUBLIC VERSION)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit A - 5/31/2019 letter from Honeywell Defendants to U.S. ITC, # 2 Exhibit B - 7/22/2019 ITC Order re Procedural Schedule, # 3 Exhibit C - 7/3/2019 ITC Protective Order, # 4 Exhibit D - 6/7/2023 Deposition Transcript of Craig Smith (Filed Under Seal in its Entirety), # 5 Exhibit E - 7/9/2019 letters from counsel for OPTO)(Pleune, S.) (Entered: 06/20/2023)
06/20/2023	247	MOTION to Seal Document 245 Sealed Document,, *Honeywell's Memorandum in Support of its Third Motion in Limine* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/5/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 06/20/2023)
06/20/2023	248	MEMORANDUM in Support re 247 MOTION to Seal Document 245 Sealed Document,, *Honeywell's Memorandum in Support of its Third Motion in Limine* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 06/20/2023)
06/20/2023	249	Sealed Document (*Sealed - Attorney*): Defendant OPTO Electronics Co., Ltd.'s Proposed Findings of Fact and Conclusions of Law by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Muckenfuss, Robert) (Entered: 06/20/2023)
06/20/2023	250	Proposed Findings of Fact by OPTO Electronics Co., Ltd.(Muckenfuss, Robert) (Entered: 06/20/2023)
06/20/2023	251	MOTION in Limine *(Defendant's Motions in Limine)* by OPTO Electronics Co., Ltd.. Responses due by 7/5/2023 (Muckenfuss, Robert) (Entered: 06/20/2023)
06/20/2023	252	Sealed Document (*Sealed - Attorney*): Opening Brief in Support of re: 251 MOTION in Limine *(Defendant's Motions in Limine)* by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit 1: (Filed with Public Version of

		Brief), # 2 Exhibit 2: Tanaka Deposition Excerpts (SEALED), # 3 Exhibit 3: Rebuttal Expert Report of R. Herrington (SEALED), # 4 Exhibit 4: Honeywell's First Amended Responses to Interrogatories (SEALED), # 5 Exhibit 5: Kohmo Deposition Excerpts (SEALED))(Muckenfuss, Robert) (Entered: 06/20/2023)
06/20/2023	253	MEMORANDUM in Support re 251 MOTION in Limine *(Defendant's Motions in Limine)* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1: Tanaka Deposition Ex. 3, # 2 Exhibit 2: Tanaka Deposition Excerpts - Filed Under Seal, # 3 Exhibit 3: Herrington Rebuttal Report - Filed Under Seal, # 4 Exhibit 4: Honeywell's First Amended Responses to Interrogatories - Filed Under Seal, # 5 Exhibit 5: Kohmo Deposition Excerpts - Filed Under Seal)(Muckenfuss, Robert) (Entered: 06/20/2023)
06/20/2023	254	Sealed Document (*Sealed - Attorney*): Defendant's Trial Brief by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Muckenfuss, Robert) (Entered: 06/20/2023)
06/20/2023	255	Sealed Document (*Sealed - Attorney*): Honeywell's Trial Brief (Jury Trial) by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit Exhibit Index, # 2 Exhibit A - 7/1/2019 Pleune letter to Chu, # 3 Exhibit B - Executed Honeywell OPTO Agreement, # 4 Exhibit C - 6/7/2023 Honeywell's Second Amended Interrogatory Responses, # 5 Exhibit D - 12/27/2022 OPTO's Second Supplemental Objections & Responses to Honeywell's First Set of Interrogatories, # 6 Exhibit E - 10/21/2022 Expert Report of Ryan N. Herrington, # 7 Exhibit F - 4/12/2023 Rebuttal Expert Report of Ryan N. Herrington, # 8 Exhibit G - 10/21/2022 Expert Report of Craig Smith, # 9 Exhibit H - 5/31/2023 Supplemental Expert Report of Craig Smith, # 10 Exhibit I - 10/21/2022 Expert Report of David O. Taylor, # 11 Exhibit J - 11/18/2022 Rebuttal Expert Report of David O. Taylor, # 12 Exhibit K - 10/21/2022 Expert Report of Ynjiun Wang)(Pleune, S.) (Entered: 06/20/2023)
06/20/2023	256	TRIAL BRIEF *(Public, Redacted Version)* by OPTO Electronics Co., Ltd.(Muckenfuss, Robert) (Entered: 06/20/2023)
06/20/2023	257	Consent MOTION to Seal Document 254 Sealed Document, 249 Sealed Document, 252 Sealed Document,, by OPTO Electronics Co., Ltd.. Responses due by 7/5/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 06/20/2023)
06/20/2023	258	TRIAL BRIEF *(Jury Trial)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Attachments: # 1 Exhibit Exhibit Index, # 2 Exhibit A - 7/1/2019 Pleune letter to Chu, # 3 Exhibit B - Executed Honeywell/OPTO Agreement (REDACTED), # 4 Exhibit C - 6/7/2023 Honeywell's Second Amended Interrogatory Responses, # 5 Exhibit D - 12/27/2022 OPTO's Second Supplemental Objections & Responses to Honeywell's First Set of Interrogatories, # 6 Exhibit E - 10/21/2022 Expert Report of Ryan N. Herrington, # 7 Exhibit F - 4/12/2023 Rebuttal Expert Report of Ryan N. Herrington, # 8 Exhibit G - 10/21/2022 Expert Report of Craig Smith, # 9 Exhibit H - 5/31/2023 Supplemental Expert Report of Craig Smith, # 10 Exhibit I - 10/21/2022 Expert Report of David O. Taylor, # 11 Exhibit J - 11/18/2022 Rebuttal Expert Report of David O. Taylor, # 12 Exhibit K - 10/21/2022 Expert Report of Ynjiun Wang)(Pleune, S.) (Entered: 06/20/2023)
06/20/2023	259	MEMORANDUM in Support re 257 Consent MOTION to Seal Document 254 Sealed Document, 249 Sealed Document, 252 Sealed Document,, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 06/20/2023)
06/20/2023	260	MOTION to Seal Document 255 Sealed Document,,,, *Honeywell's Trial Brief (Jury Trial)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc..

		Responses due by 7/5/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 06/20/2023)
06/20/2023	261	MEMORANDUM in Support re 260 MOTION to Seal Document 255 Sealed Document,,,, *Honeywell's Trial Brief (Jury Trial)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 06/20/2023)
06/20/2023	262	Sealed Document (*Sealed - Attorney*): Honeywell's Trial Brief for the Bench Trial Regarding OPTO's Patent Misuse Counterclaim by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A - 4/11/2022 Motion Hearing Transcript)(Pleune, S.) (Entered: 06/20/2023)
06/20/2023	263	TRIAL BRIEF *(Bench Trial) (PUBLIC REDACTED VERSION)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Attachments: # 1 Exhibit A - 4/11/2022 Motion Hearing Transcript)(Pleune, S.) (Entered: 06/20/2023)
06/20/2023	264	MOTION to Seal Document 262 Sealed Document, *Honeywell's Trial Brief (Bench Trial)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/5/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 06/20/2023)
06/20/2023	265	MEMORANDUM in Support re 264 MOTION to Seal Document 262 Sealed Document, *Honeywell's Trial Brief (Bench Trial)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 06/20/2023)
06/20/2023	266	Sealed Document (*Sealed - Attorney*): Honeywell's Proposed Findings of Fact & Conclusions of Law by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Pleune, S.) (Entered: 06/20/2023)
06/20/2023	267	Proposed Findings of Fact by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.(Pleune, S.) (Entered: 06/20/2023)
06/20/2023	268	MOTION to Seal Document 266 Sealed Document, *Honeywell's Proposed Findings of Fact & Conclusions of Law* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/5/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 06/20/2023)
06/20/2023	269	MEMORANDUM in Support re 268 MOTION to Seal Document 266 Sealed Document, *Honeywell's Proposed Findings of Fact & Conclusions of Law* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 06/20/2023)
06/21/2023		NOTICE of Hearing: Pretrial Conference set for 7/13/2023 09:30 AM in Courtroom #4B, 401 W Trade St, Charlotte, NC 28202 before District Judge Kenneth D. Bell. *This is your only notice - you will not receive a separate document.*(mek) (Entered: 06/21/2023)
06/22/2023	270	**ORDER granting 236 , 242 , 247 , 257 , 260 , 264 , and 268 Motion to Seal Document. IT IS FURTHER ORDERED that if they have not already done so, the parties shall file publicly available versions of every sealed document redacted only to the extent necessary on or before June 23, 2023 Signed by US Magistrate Judge David Keesler on 6/21/2023. (brl)** (Entered: 06/22/2023)
06/22/2023	271	MOTION to Continue Docket Call/Trial by OPTO Electronics Co., Ltd.. Responses due by 7/6/2023 (Muckenfuss, Robert) (Entered: 06/22/2023)

06/23/2023	272	**ORDER denying Defendant's 271 Motion for Continuance of the Trial Date; and granting Defendant's 226 Motion for Protective Order. This case shall proceed to trial on the merits on the remaining claims on July 17, 2023, in the absence of a voluntary resolution of the dispute among the parties. Signed by District Judge Kenneth D. Bell on 6/23/2023. (mek)** (Entered: 06/23/2023)
06/27/2023	273	Proposed Jury Instructions by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.(Pleune, S.) (Entered: 06/27/2023)
06/27/2023		NOTICE of Hearing **RESET AS TO DATE AND TIME**: Pretrial Conference **RESET** for 7/11/2023 02:00 PM in Courtroom #4B, 401 W Trade St, Charlotte, NC 28202 before District Judge Kenneth D. Bell. *This is your only notice - you will not receive a separate document.*(mek) (Entered: 06/27/2023)
06/29/2023	274	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 251 Motion in Limine by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 7/6/2023 (Attachments: # 1 Exhibit Index of Sealed Exhibits, # 2 Exhibit A - Source Code Log File, # 3 Exhibit D - 9/6/2022 Honeywell's Objections & Responses to First Set of Interrogatories, # 4 Exhibit E - 6/7/2023 Honeywell's Second Amended Objections & Responses to First Set of Interrogatories, # 5 Exhibit F - 6/30/2022 Honeywell's First Amended Objections & Responses to First Set of Interrogatories)(Pleune, S.) (Entered: 06/29/2023)
06/29/2023	275	RESPONSE to Motion re 251 MOTION in Limine *(Defendant's Motions in Limine) (PUBLIC VERSION)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 7/6/2023 (Attachments: # 1 Exhibit Index of Public Exhibits, # 2 Exhibit A - Source Code Log File (Redacted in its Entirety), # 3 Exhibit B - 2/24/2022 Independent Auditor's Response and Internal Control Audit Report (Public Version), # 4 Exhibit C - 1/5/2023 Excerpted Deposition of David O. Taylor (Public Version), # 5 Exhibit D - 9/6/2022 Honeywell's Objections and Responses to First Set of Interrogatories (Public Version), # 6 Exhibit E - 6/7/2023 Honeywell's Second Amended Objections & Responses to First Set of Interrogatories (Public Version), # 7 Exhibit F - 6/30/2022 Honeywell's First Amended Objections & Responses to First Set of Interrogatories (Public Version))(Pleune, S.) (Entered: 06/29/2023)
06/29/2023	276	Consent MOTION to Seal Document 274 Sealed Response to Motion,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/13/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 06/29/2023)
06/29/2023	277	MEMORANDUM in Support re 276 Consent MOTION to Seal Document 274 Sealed Response to Motion,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 06/29/2023)
06/29/2023	278	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 233 Motion in Limine, by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 7/6/2023 (Attachments: # 1 Exhibit 1: S. Tanaka Deposition Excerpts (Filed Under Seal))(Muckenfuss, Robert) (Entered: 06/29/2023)
06/29/2023	279	RESPONSE in Opposition re 233 MOTION in Limine *Honeywell's First Motion In Limine to Exclude Testimony or Argument About Information Learned Solely from Communications Between OPTO and Its Counsel* by OPTO Electronics Co., Ltd.. Replies due by 7/6/2023 (Attachments: # 1 Exhibit 1: Filed Under Seal)(Muckenfuss, Robert) (Entered: 06/29/2023)

06/29/2023	280	RESPONSE in Opposition re 239 Second MOTION in Limine *CORRECTED Second Motion in Limine to Exclude Evidence or Argument About the Interpretation of "2D Barcode Products" or "1D Barcode Products"* by OPTO Electronics Co., Ltd.. Replies due by 7/6/2023 (Muckenfuss, Robert) (Entered: 06/29/2023)
06/29/2023	281	RESPONSE in Opposition re 244 Third MOTION in Limine *Honeywell's Third Motion in Limine to Exclude Evidence or Argument Regarding Honeywell's Infringement Contentions from the ITC Investigation* by OPTO Electronics Co., Ltd.. Replies due by 7/6/2023 (Attachments: # 1 Exhibit 1: ITC Order 13, # 2 Exhibit 2: Honeywell's Response to ITC Order 13, # 3 Exhibit 3: E-mail Thread, # 4 Exhibit 4: OPTO's Initial Disclosures)(Muckenfuss, Robert) (Entered: 06/29/2023)
06/29/2023	282	Consent MOTION to Seal Document 278 Sealed Response to Motion, by OPTO Electronics Co., Ltd.. Responses due by 7/13/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 06/29/2023)
06/29/2023	283	MEMORANDUM in Support re 282 Consent MOTION to Seal Document 278 Sealed Response to Motion, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 06/29/2023)
06/30/2023	284	**ORDER granting 276 Honeywell's Consent Motion to Seal Document No. 274 . Signed by US Magistrate Judge David Keesler on 6/30/23. (mga) (Entered: 06/30/2023)**
06/30/2023	285	**ORDER granting 282 Defendant's Consent Motion To File Its Response To 251 Motion In Limine Under Seal. Document No. 278 shall remain under SEAL until otherwise ordered by this Court. Signed by US Magistrate Judge David Keesler on 6/30/23. (mga) (Entered: 06/30/2023)**
07/03/2023	286	Sealed Document (*Sealed - Attorney*): Deposition Designations by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Pleune, S.) (Entered: 07/03/2023)
07/03/2023	287	Excerpts of Deposition Testimony of Kohmo, Stoop, Tanaka *(Sealed - Participants)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Attachments: # 1 Exhibit A - Deposition Designations for Y. Kohmo, # 2 Exhibit B - Deposition Designations for K. Stoop, # 3 Exhibit C - Deposition Designations for S. Tanaka)(Pleune, S.) (Entered: 07/03/2023)
07/03/2023	288	MOTION to Seal Document 286 Sealed Document *Deposition Designations for Y. Kohmo, B. Stoop & S. Tanaka* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/17/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 07/03/2023)
07/03/2023	289	MEMORANDUM in Support re 288 MOTION to Seal Document 286 Sealed Document *Deposition Designations for Y. Kohmo, B. Stoop & S. Tanaka* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 07/03/2023)
07/03/2023	290	SEALED REPLY *(Sealed - Attorney)* to Response to Motion re: 251 Motion in Limine by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit : David Taylor Deposition Excerpts)(Muckenfuss, Robert) (Entered: 07/03/2023)
07/03/2023	291	REPLY to Response to Motion re 251 MOTION in Limine *(Defendant's Motions in Limine) - Public/Redacted Version* by OPTO Electronics Co., Ltd.. (Attachments: # 1

		Exhibit 1: David Taylor Deposition Excerpts (Filed Under Seal))(Muckenfuss, Robert) (Entered: 07/03/2023)
07/03/2023	292	SEALED REPLY *(Sealed - Attorney)* to Response to Motion re: 233 Motion in Limine, by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A - Excerpts from 9/28/2022 S. Tanaka deposition)(Pleune, S.) (Entered: 07/03/2023)
07/03/2023	293	REPLY to Response to Motion re 233 MOTION in Limine *Honeywell's First Motion In Limine to Exclude Testimony or Argument About Information Learned Solely from Communications Between OPTO and Its Counsel (PUBLIC REDACTED VERSION)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit A - Excerpts from 9/28/2022 S. Tanaka deposition (FILED UNDER SEAL), # 2 Exhibit B - Declaration of M. Scott Stevens, # 3 Exhibit C - 1/12/2023 email from Z. McCamey)(Pleune, S.) (Entered: 07/03/2023)
07/03/2023	294	MOTION to Seal Document 292 Sealed Reply to Response to Motion, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/17/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 07/03/2023)
07/03/2023	295	Excerpts of Deposition Testimony of Kees Stoop & Shigeaki Tanaka *(Sealed - Participants)* by OPTO Electronics Co., Ltd. (Attachments: # 1 Exhibit 1: Kees Stoop Deposition Designations (Filed Under Seal), # 2 Exhibit 2: Shigeaki Tanaka Deposition Designations (Filed Under Seal))(Muckenfuss, Robert) (Entered: 07/03/2023)
07/03/2023	296	MEMORANDUM in Support re 294 MOTION to Seal Document 292 Sealed Reply to Response to Motion, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 07/03/2023)
07/03/2023	297	SEALED REPLY *(Sealed - Attorney)* to Response to Motion re: 239 Motion in Limine, by Honeywell; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A - Excerpts from 6/1/2023 R. DeWinter deposition)(Pleune, S.) (Entered: 07/03/2023)
07/03/2023	298	REPLY to Response to Motion re 239 Second MOTION in Limine *CORRECTED Second Motion in Limine to Exclude Evidence or Argument About the Interpretation of "2D Barcode Products" or "1D Barcode Products" (REDACTED PUBLIC VERSION)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit A - Excerpts from 6/1/2023 R. DeWinter deposition)(Pleune, S.) (Entered: 07/03/2023)
07/03/2023	299	MOTION to Seal Document 297 Sealed Reply to Response to Motion, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/17/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 07/03/2023)
07/03/2023	300	MEMORANDUM in Support re 299 MOTION to Seal Document 297 Sealed Reply to Response to Motion, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 07/03/2023)
07/03/2023	301	Sealed Document (*Sealed - Attorney*): Sealed Exhibits to re: 295 Excerpts of Deposition Testimony, by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit 1: Kees Stoop Deposition Designations (Filed Under Seal), # 2 Exhibit 2: Shigeaki Tanaka Deposition Designations (Filed Under Seal))(Muckenfuss, Robert) (Entered: 07/03/2023)
07/03/2023	302	Consent MOTION to Seal Document 301 Sealed Document, 290 Sealed Reply to Response to Motion, by OPTO Electronics Co., Ltd.. Responses due by 7/17/2023

		(Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 07/03/2023)
07/03/2023	303	MEMORANDUM in Support re 302 Consent MOTION to Seal Document 301 Sealed Document, 290 Sealed Reply to Response to Motion, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 07/03/2023)
07/03/2023	304	REPLY to Response to Motion re 244 Third MOTION in Limine *Honeywell's Third Motion in Limine to Exclude Evidence or Argument Regarding Honeywell's Infringement Contentions from the ITC Investigation* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit A - 9/13/2022 Honeywell's First Supplemental Objections & Responses to Pl's 30(b)(6) Notice of Deposition, # 2 Exhibit B - 5/2/2022 Honeywell's First Set of Requests for Production, # 3 Exhibit C - 8/30/2022 Honeywell's Second Requests for Production of Documents, # 4 Exhibit D - 3/8/2023 email from L. Griffin)(Pleune, S.) (Entered: 07/03/2023)
07/03/2023	305	Proposed Voir Dire by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.(Pleune, S.) (Entered: 07/03/2023)
07/05/2023	306	**ORDER granting 294 Plaintiffs' Motion to Seal Document No. 292 Sealed Reply to Response to Motion, 299 Plaintiffs' MOTION to Seal Document No. 297 Sealed Reply to Response to Motion, 302 Defendant's Consent MOTION to Seal Document Nos. 301 Sealed Document, 290 Sealed Reply to Response to Motion, 288 Plaintiffs' MOTION to Seal Document No. 286 Sealed Document *Deposition Designations for Y. Kohmo, B. Stoop & S. Tanaka*. Redacted documents due 7/7/ 2023. Signed by US Magistrate Judge David Keesler on 7/5/23. (mga)** (Entered: 07/05/2023)
07/05/2023	307	MOTION to Strike *Honeywell International Inc.'s Second Amended Objections and Responses to Defendant's First Set of Interrogatories* by OPTO Electronics Co., Ltd.. Responses due by 7/19/2023 (Muckenfuss, Robert) (Entered: 07/05/2023)
07/05/2023	308	Sealed Document (*Sealed - Attorney*): Defendant's Memorandum in Support of Its Motion to Strike re: 307 MOTION to Strike *Honeywell International Inc.'s Second Amended Objections and Responses to Defendant's First Set of Interrogatories* by OPTO Electronics Co., Ltd.; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit 1: Honeywell's Second Amended Objections and Responses to Defendant's First Set of Interrogatories)(Muckenfuss, Robert) (Entered: 07/05/2023)
07/05/2023	309	MEMORANDUM in Support re 307 MOTION to Strike *Honeywell International Inc.'s Second Amended Objections and Responses to Defendant's First Set of Interrogatories* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1: Filed Under Seal)(Muckenfuss, Robert) (Entered: 07/05/2023)
07/05/2023	310	MOTION to Seal Document 308 Sealed Document,, by OPTO Electronics Co., Ltd.. Responses due by 7/19/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 07/05/2023)
07/05/2023	311	MEMORANDUM in Support re 310 MOTION to Seal Document 308 Sealed Document,, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 07/05/2023)
07/05/2023	312	NOTICE *of Rule 26(a)(3)(B) Objections to Plaintiffs' Pretrial Disclosures* by OPTO Electronics Co., Ltd. (Attachments: # 1 Exhibit A: OPTO's Objections to Honeywell's Documents Identified in Its Pretrial Disclosures)(Muckenfuss, Robert) (Entered: 07/05/2023)
07/06/2023	313	NOTICE *of Honeywell's Objections to Defendant's Pretrial Disclosure* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Attachments: # 1 Exhibit A to objections)(Pleune, S.) (Entered: 07/06/2023)

07/06/2023		**TEXT-ONLY ORDER: The responses to OPTO Electronics Co., Ltd's 307 Motion to Strike *Honeywell International Inc.'s Second Amended Objections and Responses to Defendant's First Set of Interrogatories* are due by 7/10/2023. Entered by District Judge Kenneth D. Bell on 7/6/2023. (brl)** (Entered: 07/06/2023)
07/07/2023	314	**ORDER granting 310 Defendant's Motion to Seal Document No. 308 . Signed by US Magistrate Judge David Keesler on 7/7/23. (mga)** (Entered: 07/07/2023)
07/07/2023	315	MOTION to Quash *the Trial Subpoena to "Records Custodian - Honeywell International Inc."* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/21/2023 (Attachments: # 1 Exhibit A - 7/21/2022 OPTO's Notice of 30(b)(6) Deposition, # 2 Exhibit B - 6/29/2023 email from Z. McCamey, # 3 Exhibit C - 6/29/2023 subpoena to Honeywell Custodian of Records) (Pleune, S.). Modified on 7/10/2023 to remove referral (mek). (Entered: 07/07/2023)
07/07/2023	316	MEMORANDUM in Support re 315 MOTION to Quash *the Trial Subpoena to "Records Custodian - Honeywell International Inc."* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 07/07/2023)
07/07/2023	317	MOTION to Quash *the Trial Subpoena to Adam Doane, Esq.* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/21/2023 (Attachments: # 1 Exhibit A - 7/21/2022 OPTO's Notice of 30(b)(6) Deposition, # 2 Exhibit B - 6/29/2023 email from Z. McCamey, # 3 Exhibit C - 6/28/2023 subpoena to Adam Doane, Esq., # 4 Exhibit D - 5/13/2022 OPTO's Initial Disclosures, # 5 Exhibit E - 8/23/2022 Honeywell's Supplemental Initial Disclosures, # 6 Exhibit F - 6/20/2023 OPTO's Initial Witness List) (Pleune, S.). Modified on 7/10/2023 to remove referral (mek). (Entered: 07/07/2023)
07/07/2023	318	MEMORANDUM in Support re 317 MOTION to Quash *the Trial Subpoena to Adam Doane, Esq.* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 07/07/2023)
07/07/2023	319	MOTION to Quash *the Trial Subpoena to "Records Custodian - Alston & Bird LLP" [Non-party]* by Alston & Bird LLP. Responses due by 7/21/2023 (Attachments: # 1 Exhibit A - 9/28/2022 email from J. O'Brien, # 2 Exhibit B - 6/29/2023 email from Z. McCamey, # 3 Exhibit C - 10/13/2022 email from M. Connor, # 4 Exhibit D - 6/29/2023 Subpoena to "Records Custodian - Alston & Bird LLP") (Pleune, S.) Modified to remove referral on 7/10/2023 (mga). (Entered: 07/07/2023)
07/07/2023	320	MEMORANDUM in Support re 319 MOTION to Quash *the Trial Subpoena to "Records Custodian - Alston & Bird LLP" [Non-party]* by Alston & Bird LLP. (Pleune, S.) (Entered: 07/07/2023)
07/07/2023	321	NOTICE *of Objections During De Bene Esse Deposition of Paul Chartier (Joint)* by OPTO Electronics Co., Ltd. (Attachments: # 1 Exhibit A: Paul Chartier De Bene Esse Deposition Transcript, # 2 Exhibit B: Expert Report of Paul Chartier)(Muckenfuss, Robert) (Entered: 07/07/2023)
07/10/2023		**TEXT-ONLY ORDER directing Defendant to file a response by 10:00am on Tuesday, July 11, 2023 to 315 MOTION to Quash *the Trial Subpoena to "Records Custodian - Honeywell International Inc."*, 317 MOTION to Quash *the Trial Subpoena to Adam Doane, Esq.*, and 319 MOTION to Quash *the Trial Subpoena to "Records Custodian - Alston & Bird LLP" [Non-party]*. Entered by District Judge Kenneth D. Bell on 7/10/2023. (mek)** (Entered: 07/10/2023)
07/10/2023	322	RESPONSE in Opposition re 317 MOTION to Quash *the Trial Subpoena to Adam Doane, Esq.* by OPTO Electronics Co., Ltd.. Replies due by 7/17/2023 (Muckenfuss,

		Robert) (Entered: 07/10/2023)
07/10/2023	323	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 307 Motion to Strike by Honeywell; (available to Alston & Bird LLP, Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 7/17/2023 (Attachments: # 1 Exhibit Index of Sealed Exhibits, # 2 Exhibit A - 9/30/2022 Honeywell's First Amended Objections & Responses to OPTO's First Interrogatories, # 3 Exhibit B - 6/7/2023 Honeywell's Second Amended Interrogatory Responses, # 4 Exhibit C - Redlined version of Honeywell's Interrogatory Responses, # 5 Exhibit F - 12/27/2022 OPTO's Second Supplemental Responses t Honeywell's First Set of Interrogatories, # 6 Exhibit G - 4/12/2023 Rebuttal Expert Report of Ryan H. Herrington, # 7 Exhibit I - 10/21/2022 Expert Report of David O. Taylor)(Pleune, S.) (Entered: 07/10/2023)
07/10/2023	324	RESPONSE in Opposition re 319 MOTION to Quash *the Trial Subpoena to "Records Custodian - Alston & Bird LLP" [Non-party]*, 315 MOTION to Quash *the Trial Subpoena to "Records Custodian - Honeywell International Inc."* by OPTO Electronics Co., Ltd.. Replies due by 7/17/2023 (Muckenfuss, Robert) (Entered: 07/10/2023)
07/10/2023	325	RESPONSE in Opposition re 307 MOTION to Strike *Honeywell International Inc.'s Second Amended Objections and Responses to Defendant's First Set of Interrogatories (PUBLIC VERSION)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 7/17/2023 (Attachments: # 1 Exhibit Index of Public Exhibits, # 2 Exhibit A - 9/30/2022 Honeywell's First Amended Objections & Responses to OPTO's First Interrogatories (FILED UNDER SEAL), # 3 Exhibit B - 6/7/2023 Honeywell's Second Amended Interrogatory Responses (FILED UNDER SEAL), # 4 Exhibit C - Redlined version of Honeywell's Interrogatory Responses (FILED UNDER SEAL), # 5 Exhibit D - 6/5/2023 email from J. O'Brien, # 6 Exhibit E - 7/7/2023 OPTO's Amended Exhibit List, # 7 Exhibit F - 12/27/2022 OPTO's Second Supplemental Responses to Honeywell's First Set of Interrogatories (FILED UNDER SEAL), # 8 Exhibit G - 4/12/2023 Rebuttal Expert Report of Ryan H. Herrington (FILED UNDER SEAL), # 9 Exhibit H - Honeywell's First Amended Exhibit List, # 10 Exhibit I - 10/21/2022 Expert Report of David O. Taylor (FILED UNDER SEAL))(Pleune, S.) Modified document access on 7/11/2023 (mga). (Entered: 07/10/2023)
07/10/2023	326	Consent MOTION to Seal Document 323 Sealed Response to Motion,,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 7/24/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 07/10/2023)
07/10/2023	327	MEMORANDUM in Support re 326 Consent MOTION to Seal Document 323 Sealed Response to Motion,,, by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 07/10/2023)
07/11/2023	328	**ORDER granting 326 Honeywell's Consent Motion to Seal Document Nos. 325, 325-2, 325-3, 325-4, 325-7, 325-8 and 325-10. Signed by US Magistrate Judge David Keesler on 7/11/23. (mga)** (Entered: 07/11/2023)
07/11/2023		Minute Entry: PRETRIAL CONFERENCE held before District Judge Kenneth D. Bell. Motions taken under advisement, written order to issue. Plaintiffs attorney: Brandon C.E. Springer, Lauren Nichole Griffin, Matthew Scott Stevens, S. Benjamin Pleune, Stephen Richard Lareau, Nicholas Christopher Marais. Defendants attorney: Robert A. Muckenfuss, Tyler T. VanHoutan, York M. Faulkner, Zachary L. McCamey, Jessica Lynn O'Brien, Christine E. Lehman, Connor S. Houghton. Court reporter: Cheryl Nuccio. (mek) (Entered: 07/11/2023)
07/13/2023	329	TRANSCRIPT of Motions Hearing held on 7/11/23 before Judge Bell. **NOTICE RE: REDACTION OF TRANSCRIPTS: The parties have 5 business days to file a *Notice***

		***of Intent to Request Redaction* and 21 calendar days to file a *Redaction Request*. If no notice is filed, this transcript will be made electronically available to the public without redaction after 90 calendar days. Transcript may be viewed at the court public terminal or purchased through the court reporter before the 90 day deadline. After that date it may be obtained through PACER. Policy at www.ncwd.uscourts.gov** Release of Transcript Restriction set for 10/10/2023. (Reporter: Cheryl Nuccio, cheryl_nuccio@ncwd.uscourts.gov) (Entered: 07/13/2023)
07/13/2023	330	**ORDER granting and denying the following Motions as described in the Order: the Parties' 233 , 239 , 244 , and 251 Motions in Limine; Defendant's 307 Motion to Strike; and Plaintiffs' 315 , 317 and 319 Motions to Quash. Signed by District Judge Kenneth D. Bell on 7/13/2023. (mek)** (Entered: 07/13/2023)
07/13/2023	331	Witness List by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.(Pleune, S.) Modified on 7/17/2023 to remove access restriction per 7/17/2023 oral order (mek). (Entered: 07/13/2023)
07/13/2023	332	STIPULATION *of Authenticity for All Parties* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Pleune, S.) (Entered: 07/13/2023)
07/13/2023	333	Witness List by OPTO Electronics Co., Ltd.(Muckenfuss, Robert) Modified on 7/17/2023 to remove access restriction per 7/17/2023 oral order (mek). (Entered: 07/13/2023)
07/13/2023	334	Exhibit List by OPTO Electronics Co., Ltd.. (Attachments: # 1 Exhibit A: Exhibit List) (Muckenfuss, Robert) (Entered: 07/13/2023)
07/13/2023	335	Exhibit List by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc..(Pleune, S.) (Entered: 07/13/2023)
07/13/2023	336	Miscellaneous Filing by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. *Honeywell's Statement of Expert Qualifications* (Attachments: # 1 Exhibit A - CV of Ryan H. Herrington, # 2 Exhibit B - CV of Craig Smith, # 3 Exhibit C - CV of Ynjiun Wang, PhD, # 4 Exhibit D - CV of David O. Taylor) (Pleune, S.) (Entered: 07/13/2023)
07/13/2023	337	**ORDER regarding deposition designations. Signed by District Judge Kenneth D. Bell on 7/13/2023. (mek)** (Entered: 07/13/2023)
07/13/2023	338	Exhibit List *(Amended)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit A - Amended Exhibit List) (Pleune, S.) (Entered: 07/13/2023)
07/14/2023	339	**ORDER overruling the objections contained in the Parties' 321 Notice of Objections During De Bene Esse Deposition of Paul Chartier. Signed by District Judge Kenneth D. Bell on 7/14/2023. (mek)** (Entered: 07/14/2023)
07/14/2023	340	NOTICE *of Compliance* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Pleune, S.) (Entered: 07/14/2023)
07/15/2023	341	MOTION to Continue the Patent Misuse Bench Trial and Reopen Discovery Relating to That Claim by OPTO Electronics Co., Ltd.. Responses due by 7/31/2023 (Attachments: # 1 Exhibit 1: E-mail dated July 14, 2023, # 2 Exhibit 2: Transcript of Motions Hearing) (Muckenfuss, Robert) (Entered: 07/15/2023)
07/16/2023	342	RESPONSE in Opposition re 341 MOTION to Continue the Patent Misuse Bench Trial and Reopen Discovery Relating to That Claim by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 7/24/2023 (Pleune, S.) (Entered: 07/16/2023)

07/17/2023	343	Letter to Chambers from Counsel for Plaintiffs dated 7/14/2023 (mek) (Entered: 07/17/2023)
07/17/2023	344	Letter to Chambers from Counsel for Plaintiffs dated 7/16/2023 (mek) (Entered: 07/17/2023)
07/17/2023	345	Letter to Chambers from Counsel for Plaintiffs dated 7/16/2023 (mek) (Entered: 07/17/2023)
07/17/2023		**ORAL ORDER directing that the Parties' Witness Lists (Docs No. 331 and 333) are unsealed. Entered by District Judge Kenneth D. Bell on 7/17/2023. (mek)** (Entered: 07/17/2023)
07/17/2023		Minute Entry: JURY TRIAL held before District Judge Kenneth D. Bell. Jury selected and sworn. Opening Statements. Evidence Introduced. Plaintiff rested. Jury Trial set for 7/18/2023 09:00 AM in Courtroom #4B, 401 W Trade St, Charlotte, NC 28202 before District Judge Kenneth D. Bell. Plaintiffs attorney: Brandon C.E. Springer, Lauren Nichole Griffin, Matthew Scott Stevens, S. Benjamin Pleune, Stephen Richard Lareau, Nicholas Christopher Marais. Defendants attorney: Christine E. Lehman, Connor S. Houghton, Jessica Lynn O'Brien, Robert A. Muckenfuss, Tyler T. VanHoutan, York M. Faulkner, Zachary L. McCamey. Court reporter: Cheryl Nuccio. (mek) (Entered: 07/17/2023)
07/17/2023		**ORAL ORDER denying Defendant's 341 Motion to Continue the Patent Misuse Bench Trial and Reopen Discovery Relating to That Claim. Written order to issue. Entered by District Judge Kenneth D. Bell on 7/17/2023. (mek)** (Entered: 07/17/2023)
07/18/2023	346	**ORDER RETURNING TRIAL EXHIBITS. Signed by District Judge Kenneth D. Bell on 7/18/2023. (mek)** (Entered: 07/18/2023)
07/18/2023	347	**ORDER granting Defendant's 307 Motion to Strike Honeywell's Second Amended Objections and Responses to Defendant's First Set of Interrogatories as to Honeywell's response to Interrogatory 13; Honeywell will not be permitted to introduce into evidence at trial the seven patents that it identified to OPTO on July 14, 2023, in response to the Court's Order dated July 13, 2023; and denying Defendant's 341 Motion to Continue the Patent Misuse Bench Trial and Reopen Discovery. Signed by District Judge Kenneth D. Bell on 7/18/2023. (mek)** (Entered: 07/18/2023)
07/18/2023		Minute Entry: JURY TRIAL held before District Judge Kenneth D. Bell. Oral Motion for Judgment as a Matter of Law is Denied by Court. Evidence Introduced. Defendant rested. Plaintiff began rebuttal evidence. Jury Trial set for 7/19/2023 09:00 AM in Courtroom #4B, 401 W Trade St, Charlotte, NC 28202 before District Judge Kenneth D. Bell. Plaintiffs attorney: Brandon C.E. Springer, Lauren Nichole Griffin, Matthew Scott Stevens, S. Benjamin Pleune, Stephen Richard Lareau, Nicholas Christopher Marais. Defendants attorney: Robert A. Muckenfuss, Tyler T. VanHoutan, York M. Faulkner, Zachary L. McCamey, Jessica Lynn O'Brien, Christine E. Lehman, Connor S. Houghton. Court reporter: Cheryl Nuccio. (mek) (Entered: 07/18/2023)
07/19/2023	348	MOTION for Judgment as a Matter of Law *Under FRCP 50(a)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 8/2/2023 (Pleune, S.) Modified to remove referral on 7/19/2023 (mga). (Entered: 07/19/2023)
07/19/2023	349	MEMORANDUM in Support re 348 MOTION for Judgment as a Matter of Law *Under FRCP 50(a)* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 07/19/2023)

07/19/2023		**ORAL ORDER denying Plaintiffs' 348 Motion for Judgment as a Matter of Law Under FRCP 50(a). Entered by District Judge Kenneth D. Bell on 7/19/2023. (mek)** (Entered: 07/19/2023)
07/19/2023		Minute Entry: JURY TRIAL held before District Judge Kenneth D. Bell. Plaintiff rested on rebuttal evidence. Closing arguments. Courts charge. Jury retires to deliberate. Jury returns verdict. Plaintiffs attorney: Brandon C.E. Springer, Lauren Nichole Griffin, Matthew Scott Stevens, S. Benjamin Pleune, Stephen Richard Lareau, Nicholas Christopher Marais. Defendants attorney: Robert A. Muckenfuss, Tyler T. VanHoutan, York M. Faulkner, Zachary L. McCamey, Jessica Lynn O'Brien, Christine E. Lehman, Connor S. Houghton. Court reporter: Cheryl Nuccio. (mek) (Entered: 07/19/2023)
07/19/2023	350	JURY VERDICT (Attachment: # 1 Unredacted Signature Page)(mek) (Entered: 07/19/2023)
07/19/2023		Minute Entry: BENCH TRIAL held before District Judge Kenneth D. Bell. Evidence introduced. Defendant/Counter-Claimant rested. Evidence continued. Bench Trial set for 7/20/2023 09:00 AM in Courtroom #4B, 401 W Trade St, Charlotte, NC 28202 before District Judge Kenneth D. Bell. Plaintiffs attorney: Brandon C.E. Springer, Lauren Nichole Griffin, Matthew Scott Stevens, S. Benjamin Pleune, Stephen Richard Lareau, Nicholas Christopher Marais. Defendants attorney: Robert A. Muckenfuss, Tyler T. VanHoutan, York M. Faulkner, Zachary L. McCamey, Jessica Lynn O'Brien, Christine E. Lehman, Connor S. Houghton. Court reporter: Cheryl Nuccio. (mek) Modified text on 7/19/2023 (mek). (Entered: 07/19/2023)
07/20/2023		Minute Entry: BENCH TRIAL held before District Judge Kenneth D. Bell. Evidence introduced. Plaintiff/Counter-Defendant rested. The Court stated findings of fact and conclusions of law on the record. For the reasons stated on the record, Honeywell International Inc. et al's oral motion for judgment is granted; and OPTO Electronics Co., Ltd. oral motion for judgment is denied. Plaintiffs attorney: Brandon C.E. Springer, Lauren Nichole Griffin, Matthew Scott Stevens, S. Benjamin Pleune, Stephen Richard Lareau, Nicholas Christopher Marais. Defendants attorney: Robert A. Muckenfuss, Tyler T. VanHoutan, York M. Faulkner, Zachary L. McCamey, Jessica Lynn O'Brien, Christine E. Lehman, Connor S. Houghton. Court reporter: Cheryl Nuccio. (mek) Modified text on 7/20/2023 (mek). (Entered: 07/20/2023)
07/20/2023	353	**CLERK'S JUDGMENT is hereby entered in accordance with the Jury Verdict dated July 19, 2023 and the Court's July 20, 2023 oral findings. Signed by Clerk, Katherine Hord Simon. (mek)** (Entered: 07/20/2023)
07/25/2023	355	STIPULATION *Regarding Jury Verdict Damages* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. (Pleune, S.) (Entered: 07/25/2023)
07/25/2023	356	Consent MOTION to Amend 353 Clerk's Judgment by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc. Responses due by 8/8/2023 (Pleune, S.) Modified to remove referral on 7/26/2023 (mga). (Entered: 07/25/2023)
07/26/2023	357	**ORDER granting the Parties' 356 Consent Motion to Amend 356 Clerk's Judgment and amends the Judgment in this matter to enter Judgment for damages in favor of Plaintiffs on the jury verdict in the amount of $859,741. Signed by District Judge Kenneth D. Bell on 7/26/2023. (mek)** (Entered: 07/26/2023)
07/26/2023	358	**AMENDED CLERK'S JUDGMENT entered pursuant to the Court's Order dated 7/26/2023. Signed by Clerk, Katherine Hord Simon. (mek)** (Entered: 07/26/2023)
08/03/2023	359	Sealed Document (*Sealed - Attorney*): Sealed Exhibits A-B to Honeywell's Motion for Fees & Costs by Honeywell; (available to Hand Held Products, Inc., Honeywell

		International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Exhibit A - 1/20/2020 License & Settlement Agreement, # 2 Exhibit B - 8/3/2023 Declaration of M. Scott Stevens)(Pleune, S.) (Entered: 08/03/2023)
08/03/2023	360	MOTION for Attorney Fees *and Costs* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 8/17/2023 (Attachments: # 1 Exhibit Index of Public Exhibits, # 2 Exhibit A - 1/22/2020 License & Settlement Agreement (Public Version), # 3 Exhibit B - 8/3/2023 Declaration of M. Scott Stevens (Filed Under Seal), # 4 Exhibit C - 6/26/2023 email chain re parties' estimates of length of trial, # 5 Exhibit D - 1/26/2023 Correction of Numerical Data (with translation), # 6 Exhibit E - 6/27/2023 Text message re November 2022 financial statement (with translation), # 7 Exhibit F - 5/31/2019 Complaint for Patent Infringement (Honeywell v. Opticon)) (Pleune, S.). Modified to remove referral on 8/4/2023 (mga). (Entered: 08/03/2023)
08/03/2023	361	MEMORANDUM in Support re 360 MOTION for Attorney Fees *and Costs* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 08/03/2023)
08/03/2023	362	MOTION to Seal Document 359 Sealed Document, *Exhibits A-B to Honeywell's Motion for Fees & Costs* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 8/17/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 08/03/2023)
08/03/2023	363	MEMORANDUM in Support re 362 MOTION to Seal Document 359 Sealed Document, *Exhibits A-B to Honeywell's Motion for Fees & Costs* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 08/03/2023)
08/04/2023	364	**ORDER granting 362 Plaintiff's Motion to Seal Document 359 Sealed Exhibits A-B to Honeywell's Motion for Fees & Costs. Signed by US Magistrate Judge David Keesler on 8/4/23. (mga)** (Entered: 08/04/2023)
08/06/2023	365	TRANSCRIPT of Trial Proceedings, Volume I held on 7/17/23 before Judge Bell. **NOTICE RE: REDACTION OF TRANSCRIPTS: The parties have 5 business days to file a *Notice of Intent to Request Redaction* and 21 calendar days to file a *Redaction Request*. If no notice is filed, this transcript will be made electronically available to the public without redaction after 90 calendar days. Transcript may be viewed at the court public terminal or purchased through the court reporter before the 90 day deadline. After that date it may be obtained through PACER. Policy at www.ncwd.uscourts.gov** Release of Transcript Restriction set for 11/1/2023. (Reporter: Cheryl Nuccio, 704-350-7494) (Entered: 08/06/2023)
08/06/2023	366	TRANSCRIPT of Trial Proceedings, Volume II held on 7/18/23 before Judge Bell. **NOTICE RE: REDACTION OF TRANSCRIPTS: The parties have 5 business days to file a *Notice of Intent to Request Redaction* and 21 calendar days to file a *Redaction Request*. If no notice is filed, this transcript will be made electronically available to the public without redaction after 90 calendar days. Transcript may be viewed at the court public terminal or purchased through the court reporter before the 90 day deadline. After that date it may be obtained through PACER. Policy at www.ncwd.uscourts.gov** Release of Transcript Restriction set for 11/1/2023. (Reporter: Cheryl Nuccio, 704-350-7494) (Entered: 08/06/2023)
08/06/2023	367	TRANSCRIPT of Trial Proceedings, Volume III held on 7/19/23 before Judge Bell. **NOTICE RE: REDACTION OF TRANSCRIPTS: The parties have 5 business days to file a *Notice of Intent to Request Redaction* and 21 calendar days to file a *Redaction Request*. If no notice is filed, this transcript will be made electronically available to**

		the public without redaction after 90 calendar days. Transcript may be viewed at the court public terminal or purchased through the court reporter before the 90 day deadline. After that date it may be obtained through PACER. Policy at www.ncwd.uscourts.gov Release of Transcript Restriction set for 11/1/2023. (Reporter: Cheryl Nuccio, 704-350-7494) (Entered: 08/06/2023)
08/06/2023	368	TRANSCRIPT of Trial Proceedings, Volume IV held on 7/20/23 before Judge Bell. **NOTICE RE: REDACTION OF TRANSCRIPTS: The parties have 5 business days to file a *Notice of Intent to Request Redaction* and 21 calendar days to file a *Redaction Request*. If no notice is filed, this transcript will be made electronically available to the public without redaction after 90 calendar days. Transcript may be viewed at the court public terminal or purchased through the court reporter before the 90 day deadline. After that date it may be obtained through PACER. Policy at www.ncwd.uscourts.gov** Release of Transcript Restriction set for 11/1/2023. (Reporter: Cheryl Nuccio, 704-350-7494) (Entered: 08/06/2023)
08/14/2023	369	NOTICE OF APPEAL by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Filing fee $ 505, receipt number ANCWDC-6181971. *Use this link www.ca4.uscourts.gov to retrieve 4th Circuit case opening documents, i.e. Appearance of Counsel, Docketing Statement, Disclosure Statement, and Transcript Order Form.* Note: Your Transcript Order Form must be served on the District Court as well as the Circuit Court. (Pleune, S.) (Entered: 08/14/2023)
08/15/2023	370	Transmission of Notice of Appeal to US Court of Appeals re 369 Notice of Appeal (mek) (Entered: 08/15/2023)
08/16/2023	371	USCA Case Number 23-1850 for 369 Notice of Appeal, USCA Case Manager: Jeffrey S. Neal. (nvc) (Entered: 08/16/2023)
08/17/2023	372	SEALED RESPONSE *(Sealed - Attorney)* to Motion re: 360 Motion for Attorney Fees,,, by OPTO Electronics Co., Ltd.; (available to Alston & Bird LLP, Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) Replies due by 8/24/2023 (Attachments: # 1 Exhibit 1: Fees and Costs Analysis (Sealed), # 2 Exhibit 2: Settlement and License Agreement (Sealed), # 3 Exhibit 4: Document Production Invoice (Sealed), # 4 Exhibit 5: Invoice (Sealed))(Muckenfuss, Robert) (Entered: 08/17/2023)
08/17/2023	373	RESPONSE in Opposition re 360 MOTION for Attorney Fees *and Costs* by OPTO Electronics Co., Ltd.. Replies due by 8/24/2023 (Attachments: # 1 Exhibit 1: Filed Under Seal, # 2 Exhibit 2: Filed Under Seal, # 3 Exhibit 3: License and Settlement Agreement, # 4 Exhibit 4: Filed Under Seal, # 5 Exhibit 5: Filed Under Seal)(Muckenfuss, Robert) (Entered: 08/17/2023)
08/17/2023	374	MOTION for Judgment as a Matter of Law , *Alternative Rule 59 Motion for a New Trial, and Renewed Motion for Summary Judgment* by OPTO Electronics Co., Ltd.. Responses due by 8/31/2023 (Muckenfuss, Robert). Modified to remove referral on 8/18/2023 (mga). (Entered: 08/17/2023)
08/17/2023	375	Sealed Document (*Sealed - Attorney*): Brief in Support of Defendant's Rule 50 Motion for Judgment as a Matter of Law, Alternative Rule 59 Motion for a New Trial, and Renewed Motions for Summary Judgment re: 374 MOTION for Judgment as a Matter of Law , *Alternative Rule 59 Motion for a New Trial, and Renewed Motion for Summary Judgment* by OPTO Electronics Co., Ltd.; (available to Alston & Bird LLP, Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 Appendix, # 2 DX-95 (Sealed), # 3 DX-98 (Sealed), # 4 DX-111 (Sealed), # 5 DX-769 (Sealed), # 6 JX-1 (Sealed), # 7 JX-3 (Sealed))(Muckenfuss, Robert) (Entered: 08/17/2023)

08/17/2023	376	MEMORANDUM in Support re 374 MOTION for Judgment as a Matter of Law *, Alternative Rule 59 Motion for a New Trial, and Renewed Motion for Summary Judgment (Public Version)* by OPTO Electronics Co., Ltd.. (Attachments: # 1 Appendix, # 2 DX-95 (Filed Under Sealed), # 3 DX-98 (Filed Under Sealed), # 4 DX-111 (Filed Under Sealed), # 5 DX-769 (Filed Under Sealed), # 6 JX-1 (Filed Under Sealed), # 7 JX-3 (Filed Under Sealed), # 8 PX-18, # 9 PX-19, # 10 PX-87, # 11 PX-125, # 12 PX-188, # 13 PX-288, # 14 Trial Transcript Excerpts (Vol. I), # 15 Trial Transcript Excerpts (Vol. II), # 16 Trial Transcript Excerpts (Vol. III))(Muckenfuss, Robert) (Entered: 08/17/2023)
08/17/2023	377	Consent MOTION to Seal Document 375 Sealed Document,, 372 Sealed Response to Motion,, by OPTO Electronics Co., Ltd.. Responses due by 8/31/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 08/17/2023)
08/17/2023	378	MEMORANDUM in Support re 377 Consent MOTION to Seal Document 375 Sealed Document,, 372 Sealed Response to Motion,, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 08/17/2023)
08/18/2023	379	**ORDER granting 377 Defendant's Consent Motion to Seal Document Document Nos. 372, 372-1, 372-2, 372-3, 372-4, 375, 375-2, 375-3, 375-4, 375-5, 375-6, and 375-7. Redacted versions of Documents Nos. 372 and 375 due on or before August 23, 2023. Signed by US Magistrate Judge David Keesler on 8/18/23. (mga)** (Entered: 08/18/2023)
08/18/2023		Set/Reset Deadlines: Redacted documents due by 8/23/2023. (mga) (Entered: 08/18/2023)
08/24/2023	380	REPLY to Response to Motion re 360 MOTION for Attorney Fees *and Costs* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Attachments: # 1 Exhibit A)(Pleune, S.) (Entered: 08/24/2023)
08/31/2023	381	MEMORANDUM in Opposition re 374 MOTION for Judgment as a Matter of Law *, Alternative Rule 59 Motion for a New Trial, and Renewed Motion for Summary Judgment* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 9/7/2023 (Attachments: # 1 Appendix of Exhibits, # 2 JX-1 (Redacted), # 3 JX-3 (Placeholder Slipsheet), # 4 PX-4, # 5 PX-8, # 6 PX-10, # 7 PX-12, # 8 PX-18, # 9 PX-19, # 10 PX-61 (Placeholder Slipsheet), # 11 PX-87, # 12 PX-125, # 13 PX-325, # 14 Exhibit A - OPTOs Responses to Honeywells First Set of Interrogatories (Redacted)) (Pleune, S.) (Entered: 08/31/2023)
08/31/2023	382	MOTION to Seal Document *, JX-1, JX-3, PX-61 and Exhibit A, in Relation to ECF No. 381, Memorandum in Opposition* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Responses due by 9/14/2023 (Pleune, S.). Motions referred to David Keesler. (Entered: 08/31/2023)
08/31/2023	383	MEMORANDUM in Support re 382 MOTION to Seal Document *, JX-1, JX-3, PX-61 and Exhibit A, in Relation to ECF No. 381, Memorandum in Opposition* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. (Pleune, S.) (Entered: 08/31/2023)
08/31/2023	384	Sealed Document (*Sealed - Attorney*): Confidential Exhibits in Support of Opposition re: 382 MOTION to Seal Document *, JX-1, JX-3, PX-61 and Exhibit A, in Relation to ECF No. 381, Memorandum in Opposition* by Plaintiffs; (available to Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Attachments: # 1 JX-1 - License and Settlement Agreement (Unredacted), # 2 JX-3 - Second Amendment to the License and Settlement Agreement, # 3 PX-61 - Table of OPTO Interrogatory No. 3, # 4 Exhibit A - OPTOs Responses to Honeywells First Set of Interrogatories (Unredacted))(Pleune, S.) (Entered: 08/31/2023)

09/01/2023	385	**ORDER granting 382 Motion to Seal Document. Document No. 384 shall remain under SEAL until otherwise ordered by this Court. Signed by US Magistrate Judge David Keesler on 9/1/2023. (brl)** (Entered: 09/01/2023)
09/01/2023	386	MOTION for Extension of Time to File Response/Reply re: 374 MOTION for Judgment as a Matter of Law , *Alternative Rule 59 Motion for a New Trial, and Renewed Motion for Summary Judgment* by OPTO Electronics Co., Ltd.. Responses due by 9/15/2023 (Attachments: # 1 Proposed Order) (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 09/01/2023)
09/05/2023	387	RESPONSE in Opposition re 386 MOTION for Extension of Time to File Response/Reply re: 374 MOTION for Judgment as a Matter of Law , *Alternative Rule 59 Motion for a New Trial, and Renewed Motion for Summary Judgment* by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. Replies due by 9/12/2023 (Pleune, S.) (Entered: 09/05/2023)
09/05/2023	388	**ORDER granting 386 Defendant's Motion for Extension of Time to File Response/Reply re: 374 MOTION for Judgment as a Matter of Law , *Alternative Rule 59 Motion for a New Trial, and Renewed Motion for Summary Judgment* . Replies due by 9/12/2023. Signed by US Magistrate Judge David Keesler on 9/5/23. (mga)** (Entered: 09/05/2023)
09/12/2023	389	SEALED REPLY *(Sealed - Attorney)* to Response to Motion re: 374 Motion for Judgment as a Matter of Law, by OPTO Electronics Co., Ltd.; (available to Alston & Bird LLP, Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc., OPTO Electronics Co., Ltd.) (Muckenfuss, Robert) (Entered: 09/12/2023)
09/12/2023	390	REPLY to Response to Motion re 374 MOTION for Judgment as a Matter of Law , *Alternative Rule 59 Motion for a New Trial, and Renewed Motion for Summary Judgment (Public Version)* by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 09/12/2023)
09/12/2023	391	Consent MOTION to Seal Document 389 Sealed Reply to Response to Motion, by OPTO Electronics Co., Ltd.. Responses due by 9/26/2023 (Muckenfuss, Robert). Motions referred to David Keesler. (Entered: 09/12/2023)
09/12/2023	392	MEMORANDUM in Support re 391 Consent MOTION to Seal Document 389 Sealed Reply to Response to Motion, by OPTO Electronics Co., Ltd.. (Muckenfuss, Robert) (Entered: 09/12/2023)
09/13/2023	393	**ORDER granting 391 Defendant's Consent Motion to File Its Reply In Further Support Of Its Motion For Judgment As A Matter Of Law Under Seal. Document No. 390 shall remain under SEAL until otherwise ordered by this Court. Signed by US Magistrate Judge David Keesler on 9/13/23. (mga)** (Entered: 09/13/2023)
09/27/2023	394	**ORDER denying Plaintiff's 360 Motion for Attorney Fees; and denying Defendant's 374 Motion for Judgment as a Matter of Law. Signed by District Judge Kenneth D. Bell on 9/27/2023. (mek)** (Entered: 09/27/2023)
10/02/2023	395	NOTICE OF APPEAL by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. *Use this link www.ca4.uscourts.gov to retrieve 4th Circuit case opening documents, i.e. Appearance of Counsel, Docketing Statement, Disclosure Statement, and Transcript Order Form.* Note: Your Transcript Order Form must be served on the District Court as well as the Circuit Court. (No fee required) (Pleune, S.) (Entered: 10/02/2023)
10/02/2023	396	Transmission of Notice of Appeal to US Court of Appeals re 395 Notice of Appeal (mek) (Entered: 10/02/2023)

10/02/2023	397	ORDER of USCA as to 369 Notice of Appeal [23-1850] granting motion to place case in abeyance pending the adjudication of a post-trial motion by the district court. (nvc) (Entered: 10/02/2023)
10/04/2023	398	NOTICE OF APPEAL as to 358 Clerk's Judgment, 353 Clerk's Judgment, 394 Order on Motion for Attorney Fees, Order on Motion for Judgment as a Matter of Law, 195 Order on Motion for Partial Summary Judgment, Order on Motion for Summary Judgment, Order on Motion to Strike by OPTO Electronics Co., Ltd.. Filing fee $ 505, receipt number ANCWDC-6246052. *Use this link www.ca4.uscourts.gov to retrieve 4th Circuit case opening documents, i.e. Appearance of Counsel, Docketing Statement, Disclosure Statement, and Transcript Order Form.* Note: Your Transcript Order Form must be served on the District Court as well as the Circuit Court. (Muckenfuss, Robert) (Entered: 10/04/2023)
10/05/2023	399	Transmission of Notice of Appeal to US Court of Appeals re 398 Notice of Appeal(mek) (Entered: 10/05/2023)
10/06/2023	400	USCA Case Number 23-2038 for 398 Notice of Appeal, USCA Case Manager: Jeffrey S. Neal. (nvc) (Entered: 10/06/2023)
10/06/2023	401	ORDER of USCA consolidating 395 Notice of Appeal [23-1850] and 398 Notice of Appeal [23-2038]. (nvc) (Entered: 10/06/2023)
10/27/2023	402	NOTICE OF APPEAL by Hand Held Products, Inc., Honeywell International Inc., Metrologic Instruments, Inc.. *Use this link www.ca4.uscourts.gov to retrieve 4th Circuit case opening documents, i.e. Appearance of Counsel, Docketing Statement, Disclosure Statement, and Transcript Order Form.* Note: Your Transcript Order Form must be served on the District Court as well as the Circuit Court. (No fee required) (Pleune, S.) (Entered: 10/27/2023)
10/27/2023	403	Document deleted; filed on error. Modified on 10/30/2023 (mek). (Entered: 10/27/2023)
10/30/2023	404	Transmission of Notice of Appeal to Federal Circuit Court of Appeals re 402 Notice of Appeal (mek) (Entered: 10/30/2023)
11/03/2023	405	Federal Circuit Court of Appeals NOTICE OF DOCKETING re: 402 Notice of Appeal [24-1109].(nvc) (Entered: 11/03/2023)
11/07/2023	406	NOTICE OF CROSS APPEAL as to 358 Clerk's Judgment, 353 Clerk's Judgment, 394 Order on Motion for Attorney Fees, Order on Motion for Judgment as a Matter of Law by OPTO Electronics Co., Ltd.. *Use this link www.ca4.uscourts.gov to retrieve 4th Circuit case opening documents, i.e. Appearance of Counsel, Docketing Statement, Disclosure Statement, and Transcript Order Form.* Note: Your Transcript Order Form must be served on the District Court as well as the Circuit Court. (IFP) (Muckenfuss, Robert) (Entered: 11/07/2023)
11/08/2023	407	Transmission of Notice of Cross Appeal to Federal Circuit Court of Appeals re 406 Notice of Cross Appeal (mek) (Entered: 11/08/2023)
11/08/2023		Appeal Filing fee received: in amount of $ 505, paid by Plaintff re: 402 Notice of Appeal to the Federal Circuit receipt number 6624 (cjs) Modified Docket Text on 11/9/2023 (cjs). (Entered: 11/08/2023)
11/13/2023		Appeal Filing fee received: in amount of $ 505, Paid by Defendant:OPTO Electronics Co., Ltd. receipt number 6670 (cjs) (Entered: 11/13/2023)

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION

HONEYWELL INTERNATIONAL INC.,
HAND HELD PRODUCTS, INC., and
METROLOGIC INSTRUMENTS, INC.,

Plaintiffs,

v.

OPTO ELECTRONICS CO., LTD.,

Defendant.

Civil Action No. 3:21-cv-00506

JURY TRIAL DEMANDED

COMPLAINT

Plaintiffs Honeywell International Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. (collectively, "Honeywell" or "Plaintiffs"), by and through their undersigned counsel, file this Complaint against Defendant OPTO Electronics Co., Ltd. ("Opticon" or "Defendant") and allege the following:

PARTIES

1. Plaintiff Honeywell International Inc. is a Delaware corporation with its principal place of business at 855 S. Mint Street, Charlotte, North Carolina 28202.

2. Plaintiff Hand Held Products, Inc. is a Delaware corporation and a wholly owned subsidiary of Honeywell International Inc., with its principal place of business at 855 S. Mint Street, Charlotte, North Carolina 28202.

3. Plaintiff Metrologic Instruments, Inc. is a New Jersey corporation and wholly owned subsidiary of Honeywell International Inc., with its principal place of business at 855 S. Mint Street, Charlotte, North Carolina 28202.

4. Defendant OPTO Electronics Co., Ltd. is, upon information and belief, a company organized and existing under the laws of Japan, having a principal place of business at 12-17 Tsukagoshi 4-chrome, Warabi-city Saitama Pref., 335-0002, Japan.

JURISDICTION AND VENUE

5. The Court has subject-matter jurisdiction based on diversity under 28 U.S.C. § 1332(a) as Plaintiffs, on the one hand, and Defendant on the other, are citizens of different states, and the amount in controversy exceeds $75,000, excluding interests and costs.

6. The License and Settlement Agreement giving rise to this dispute was executed on January 22, 2020, by Honeywell and OPTO Electronics Co., Ltd. (the "Agreement"). A true and accurate copy of the Public Version of the Agreement, which was filed at the International Trade Commission in connection with the settlement of that dispute, is attached hereto as Exhibit A. The Public Version of the Agreement redacts certain provisions deemed confidential by one or both of the parties thereto.

7. Personal jurisdiction over Defendant is appropriate because the parties to the Agreement consented to the exclusive jurisdiction of courts in the State of North Carolina over any suit, action, or proceeding arising out of or relating to the Agreement.

8. Venue in this District is appropriate because the Agreement between the parties to this dispute states that any dispute arising out of the Agreement must be brought in the appropriate state or federal courts of the State of North Carolina.

9. Venue in this District is also appropriate under 28 U.S.C. § 1391.

FACTUAL ALLEGATIONS

PRIOR LITIGATION BETWEEN THE PARTIES

10. On May 31, 2019, Honeywell filed a Complaint for Patent Infringement against Opticon in the District of Delaware, Civil Number 1-19-cv-01019 (the "Delaware Action").

11. On May 31, 2019, contemporaneous with the Delaware Action, Honeywell filed a Complaint under Section 337 of the Tariff of Act of 1930 at the United States International Trade Commission, asking the Commission to prohibit entry of certain Opticon products into the United States on the basis that the products infringed certain Honeywell patents.

12. On June 27, 2019, the Commission issued a *Notice of Institution of Investigation*, as to all claims alleged by Honeywell. The Investigation was assigned Investigation Number 337-TA-1165 (the "ITC Investigation").

SETTLEMENT AND SETTLEMENT AGREEMENT

13. On January 22, 2020, Honeywell and Opticon entered into the Agreement, which resolved the dispute among the parties in the ITC Investigation and in the Delaware Action.

14. Following execution of the Agreement, the parties jointly filed motions to dismiss the Delaware Action on February 21, 2020 and to terminate the ITC Investigation on February 18, 2020. Accordingly, the Delaware Action and the ITC Investigation were subsequently dismissed and terminated, respectively.

15. The terms of the Agreement include a license grant from Honeywell to Opticon. In consideration of this license, the Agreement requires Opticon to pay to Honeywell a specified percent of Opticon's gross revenue derived from the sales of "2D Barcode Products" in the United States.

16. The Agreement defines "2D Barcode Products" as "any device or article of manufacture that is operable to decode at least one or more two-dimensional barcode symbologies into human-readable text. Two-dimensional ('2D') barcode symbologies include, but are not limited to, any two-dimensional barcode symbology defined by one or more standards setting organizations such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), and the Association for Automatic Identification and Mobility (AIM). For the avoidance of doubt, the term '2D Barcode Products' shall include Engines and other products that include a 2D image sensor and are capable of outputting a 2D image that may be used to decode a 2D barcode symbology into human-readable text."

17. Among the 2D Barcode Products that Opticon has sold, and continues to sell, in the United States are at least the following products: OPN-2006; NLB-1000; NLV-1001; RLB-1000; L-46R; OPH-1005; OPH-3001; OPL-6845R; OPL-9815; OPR-2001Z; OPR-2001; OPR-3201; OPR-3201Z; RS-2006/OPN2006; MDL-1000; MDL-1500; MDL-2001; MSL-1000; and OPR-3101.

18. By way of example, the Opticon-published Product Specifications for the L-46R indicate that its "Supported symbologies" include "2D code: PDF417; MicroPDF417" (*see* Exhibit B).

<u>BREACH OF THE AGREEMENT</u>

19. Under Section 5.1 of the Agreement, Opticon made certain representations and warranties to Honeywell, including a representation concerning its gross revenue from sales of 2D Barcode Products over the previous several years ("Opticon's Representations").

20. The Agreement also contains certain audit provisions that allow Honeywell to review records to verify the accuracy of Opticon's Representations.

21. The Agreement provides that if the audit shows that Opticon's actual revenues exceed the represented amount by a certain margin, then Opticon must pay Honeywell a percentage of the amount of revenue exceeding the amount represented, plus the costs of the audit.

22. On December 16, 2020, Honeywell notified Opticon that it was invoking its audit rights under the Agreement.

23. The audit showed that Opticon's revenues from sales of 2D Barcode Products were actually tens of millions of dollars more than Opticon represented in the Agreement, in part because Opticon had excluded certain 2D Barcode Products from its calculations.

24. Opticon therefore breached its representations and warranties and materially breached the Agreement. Because of that breach, Honeywell is entitled to certain monetary damages specified in the Agreement.

OVERDUE ROYALTY PAYMENTS

25. Section 4.3 of the Agreement states that Opticon shall pay to Honeywell a royalty. Pursuant to the terms of the Agreement, the royalty is based on Royalty-Bearing Products, which covers any Opticon Licensed Product, which was defined to include 2D Barcode Products.

26. Section 4.6 of the Agreement states that if Opticon fails to make a required royalty payment, then Opticon incurs a late charge of one and a half percent (1.5%) per month on the late payments. Such late charge accrues from the first day after the payment was due.

27. Opticon has failed to include all 2D Barcode Products in its calculation of quarterly royalty payments owed to Honeywell.

28. Based on the plain terms of the Agreement, Opticon is obligated to pay a royalty on its sales of all 2D Barcode Products. Opticon still owes Honeywell a royalty on sales of certain

2D Barcode Products that have not been paid to date, as well as a late charge of one and a half percent (1.5%) per month on the amounts not paid when they were originally due.

FEES AND COSTS

29. Section 4.7 of the Agreement states that in the event a party institutes an action to collect any overdue payments, that party shall be entitled to its fees and costs incurred with respect to such action.

COUNT I
Breach of Contract

30. Honeywell incorporates, by reference, the allegations contained in Paragraphs 1 – 29 as if set forth herein.

31. The Agreement is a valid and enforceable contract.

32. The Agreement is not ambiguous.

33. Opticon breached its representation under Section 5.1 of the Agreement.

34. Due to Opticon's breach of its Section 5.1 representation, it owes Honeywell the monetary damages set forth in Section 5.1.

35. Opticon has not paid, and continues to fail to pay, the full royalty delineated in Section 4 of the Agreement.

36. Due to Opticon's breach of Section 4 of the Agreement, it owes Honeywell the missing royalties defined in that section.

37. Opticon also owes Honeywell a late fee of one and a half percent (1.5%) per month for the missed royalty payments.

38. Honeywell has been and continues to be damaged as a result of Opticon's breach.

39. Honeywell is entitled to recover damages resulting from Opticon's breach of the Agreement.

40. Honeywell is entitled to recover its fees and costs incurred with respect to its recovery of the unpaid and overdue payments.

PRAYER FOR RELIEF

WHEREFORE, Honeywell prays for the entry of a judgment from this Court in its favor and against Opticon and respectfully requests the following relief:

a) That Honeywell recover damages resulting from Defendant's breach of the License and Settlement Agreement;

b) That the Court enter judgment in favor of Honeywell for pre-judgment and post-judgment interest at the legal rate;

c) That the Court award Honeywell its fees and costs incurred with respect to this action;

d) That all costs be assessed against Defendant; and

e) That the Court award such other relief as is just and proper.

JURY TRIAL DEMAND

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, Honeywell requests a trial by jury on any issues so triable by right.

Dated: September 24, 2021

Respectfully submitted

/s/ *Mark T. Calloway*
Mark T. Calloway (NC Bar No. 10822)
Michael R. Hoernlein (NC Bar No. 40419)
Brandon Springer (NC Bar No. 54523)
S. Benjamin Pleune (NC Bar No. 28748)
M. Scott Stevens (NC Bar No. 37828)
Stephen R. Lareau (NC Bar No. 42992)
Lauren N. Griffin (NC Bar No. 54766)
ALSTON & BIRD LLP
101 S. Tryon Street
Suite 4000
Charlotte, NC 28280
Telephone: (704) 444-1000
Facsimile: (704) 444-1935

Counsel for Plaintiffs
Honeywell International Inc.,
Hand Held Products, Inc., and
Metrologic Instruments, Inc.

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION

HONEYWELL INTERNATIONAL, INC., HAND HELD PRODUCTS, INC., METROLOGIC INSTRUMENTS, INC., *Plaintiffs,* v. OPTO ELECTRONICS CO., LTD., *Defendant.*	Civil Action No.

<u>EXHIBIT A TO COMPLAINT</u>

PUBLIC VERSION

THE UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

Before The Honorable MaryJoan McNamara
Administrative Law Judge

In the Matter of **CERTAIN BARCODE SCANNERS, SCAN ENGINES, PRODUCTS CONTAINING THE SAME, AND COMPONENTS THEREOF**	**Investigation No. 337-TA-1165**

JOINT MOTION TO TERMINATE INVESTIGATION NO. 337-TA-1165
ON THE BASIS OF A SETTLEMENT AGREEMENT

Complainants Honeywell International Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. (collectively, "Honeywell") and Respondents Opticon, Inc., Opticon Sensors Europe B.V., OPTO Electronics Co., Ltd., and Hokkaido Electronic Industry Co., Ltd. (collectively, "Opticon") respectfully request that Investigation No. 337-TA-1165 be terminated pursuant to 19 U.S.C. § 1337(c) and 19 C.F.R. § 210.21(b) in view of a confidential License and Settlement Agreement ("Agreement") between Honeywell and Opticon. The Agreement resolves all of the issues in dispute in this investigation.

The Agreement has been executed by Honeywell and Opticon and is fully effective between them. The Agreement is attached hereto as Exhibit 1, and it contains Confidential Business Information within the meaning of 19 C.F.R. § 201.6. Accordingly, Honeywell and Opticon request that the Agreement be treated as Complainants' and Respondents' Confidential Business Information under the Protective Order in this proceeding. A redacted, non-confidential

version of the Agreement is attached as Exhibit 2 and will be filed with the public version of this Joint Motion to Terminate.

The Agreement resolves the dispute between Honeywell and Opticon in this investigation. The Agreement reflects the entire and only agreement between Honeywell and Opticon regarding the subject matter of this proceeding. There are no other agreements, written or oral, express or implied, between Honeywell and Opticon regarding the subject matter of this proceeding.

In view of the attached Agreement, there no longer exists a basis upon which to continue this investigation. Furthermore, termination of this proceeding pursuant to the Agreement poses no threat to the public interest. Indeed, it is in the interest of the public and administrative economy to grant this motion. Commission policy and the public interest generally favor settlements, which preserve resources for both the Commission and the private parties, and termination based on a settlement agreement is routinely granted. *See, e.g., Certain Mobile Telephones and Wireless Communications Devices Featuring Digital Cameras*, , Inv. No. 337-TA-663, Order No. 54 at 2-3 (Jan. 15, 2010); *Certain Synchronous Dynamic Random Access Memory Devices, Microprocessors, and Products Containing Same*, Inv. No. 337-TA-431, Order No. 11 at 2 (July 12, 2000); *Certain Integrated Circuit Chipsets*, Inv. No. 337-TA-428, Order No. 16 at 5 (Aug. 22, 2000).

GROUND RULE 2.2 CERTIFICATION

This is a joint motion on behalf of the parties and thus no party opposes.

CONCLUSION

For the reasons set forth above, Honeywell and Opticon respectfully request that the ALJ and Commission terminate Investigation No. 337-TA-1165 in its entirety in accordance with the provisions of 19 U.S.C. § 1337(c) and 19 C.F.R. § 210.21(b) based on the Agreement.

PUBLIC VERSION

Dated: February 18, 2020

By: */s/ M Scott Stevens* M. Scott Stevens **ALSTON & BIRD LLP** 950 F Street NW Washington, DC 20004 Telephone: (202) 239-3025 Facsimile: (704) 444-1035 S. Benjamin Pleune Stephen R. Lareau Adam J. Doane Nicholas C. Marais Lauren N. Bond **ALSTON & BIRD LLP** 101 South Tryon Street, Suite 4000 Charlotte, NC 28280 Telephone: (704) 444-1098 Facsimile: (704) 444-1698 Yuri Mikulka **ALSTON & BIRD LLP** 333 South Hope Street, 16th Floor Los Angeles, CA 90071 Telephone: (213) 576-1026 *Counsel for Complainants* *Honeywell International, Inc.,* *Hand Held Products, Inc.,* *and Metrologic Instruments, Inc.*	By: */s/ Jeffrey S. Gerchick* S. Alex Lasher Jeffrey S. Gerchick Jared W. Newton K. Kevin Chu QUINN EMANUEL URQUHART & SULLIVAN, LLP 1300 I Street, NW, Suite 900 Washington, D.C. 20005 Tel.: (202) 538-8000 Richard W. Erwine Kevin Jang QUINN EMANUEL URQUHART & SULLIVAN, LLP 51 Madison Ave. New York, NY 10010 Tel.: (212) 849-7000 Steven Cherny Patrick D. Curran QUINN EMANUEL URQUHART & SULLIVAN, LLP 111 Huntington Ave, Suite 520 Boston, MA 02199 Tel.: (617) 712-7100 Ryan S. Goldstein York M. Faulkner QUINN EMANUEL URQUHART & SULLIVAN, LLP Hibiya U-1 Bldg., 25F 1-1-7, Uchisaiwai-cho Chiyoda-ku, Tokyo, 100-0011 Japan Tel.: +81 3 5510 1711 Koichiro Minamino MINAMINO LAW OFFICE, PLLC 1300 I Street, N.W. Suite 900 Washington, DC 20005 Tel.: (202) 777-3638 *Counsel for Respondents* *Opticon, Inc., Opticon Sensors Europe B.V.,*

	OPTO Electronics Co., Ltd.,and *Hokkaido Electronic Industry Co., Ltd.*

EXHIBIT 1

(Confidential; redacted in its entirety)

Public Version

EXHIBIT 2

[redacted]

LICENSE AND SETTLEMENT AGREEMENT

This License and Settlement Agreement ("**Agreement**") is made and entered into, effective as of the 22nd day of January 2020 (the "**Effective Date**"), by and between:

OPTO Electronics Co., Ltd., a company organized and existing under the laws of Japan, with its principal place of business located at 12-17, Tsukagoshi 4-chome, Warabi-city Saitama Pref., 335-0002, Japan ("**OPTO ELECTRONICS**"),

Opticon Sensors Europe B.V., a company organized and existing under the law of The Netherlands, with its principal place of business located at Opaallaan 35, 2132 XV Hoofddorp, The Netherlands ("**OPTICON SENSORS**"),

Opticon, Inc., a Delaware Corporation, with its principal place of business located at 2200 Lind Ave. SW, Suite 100, Renton, WA 98057 ("**OPTICON INC**"), and

Hokkaido Electronic Industry Co., Ltd., a/k/a Hokkaido Electronic Co., Ltd. and Hokkaido Electronics Industrial Co., Ltd., a company organized and existing under the laws of Japan, with its principal place of business located at 118-122 Kamiashibetsu-cho, Ashibetsu-shi, Hokkaido, 079-1371, Japan ("**HOKKAIDO**") (OPTO ELECTRONICS, OPTICON SENSORS, OPTICON INC, HOKKAIDO, and the Affiliates thereof are collectively referred to as "**OPTICON**"), on the one hand; and

Honeywell International Inc., a Delaware corporation, with its principal place of business at 300 S. Tryon Street, Suite 600, Charlotte, NC 28202 ("**HONEYWELL INTERNATIONAL**"),

Hand Held Products, Inc., a Delaware corporation, with its principal place of business located at 300 S. Tryon Street, Suite 500, Charlotte, NC 28202 ("**HAND HELD**"), and

Metrologic Instruments, Inc., a New Jersey corporation, with its principal place of business at 300 S. Tryon Street, Suite 500, Charlotte, NC 28202 ("**METROLOGIC**") (HONEYWELL INTERNATIONAL, HAND HELD, METROLOGIC, and the Affiliates thereof are collectively referred to as "**HONEYWELL**"), on the other hand.

OPTICON and HONEYWELL shall be referred to herein collectively as the "**Parties**" and individually as a "**Party**."

BACKGROUND

A. In International Trade Commission ("**ITC**") investigation 337-TA-1165 ("**ITC INVESTIGATION**"), initiated by a complaint filed by HONEYWELL on May 31, 2019, HONEYWELL accused OPTICON's imported barcode scanners, scan engines, products containing the same, and components thereof of infringing claims of United States Patent Nos. 9,465,970; 8,978,985; 7,527,206; 7,148,923; 9,659,199; 7,159,783; and 8,794,520 owned by HAND HELD or METROLOGIC and sought a permanent limited exclusion order prohibiting entry into the United States of those barcode scanners, scan engines, products containing the same, and components thereof, as well as a permanent cease and desist orders prohibiting OPTICON from importing, admitting or withdrawing from a foreign trade zone, marketing, advertising, demonstrating, warehousing inventory, distributing, offering for sale, selling, licensing, repairing, programing, packaging, repackaging, bundling, or updating OPTICON's barcode scanners, scan engines, products containing the same, and components thereof.

K. 1

[redacted]

B. In civil action 1:19-cv-01019-CFC filed in the United States District Court for the District of Delaware (**"DELAWARE ACTION"**), HONEYWELL asserted claims against OPTICON for infringing claims of the same patents that were at issue in the ITC INVESTIGATION and sought a declaration of infringement, damages, interest, attorney fees, and accounting of damages, costs of suit, and equitable relief. The ITC INVESTIGATION and DELAWARE ACTION are collectively referred to herein as the **"LEGAL ACTIONS."**

C. In the LEGAL ACTIONS, OPTICON denied infringement of all asserted claims of each of the patents at issue and alleged that these claims were invalid under 35 U.S.C. §§ 102, 103 and/or 112.

D. The Parties desire to avoid any further litigation, risks and expenses relating to the LEGAL ACTIONS in order to reach a resolution without admitting infringement or liability, and to seek an amicable and final business resolution and settlement of the LEGAL ACTIONS and any and all other claims which were, or could have been, asserted by the Parties in the LEGAL ACTIONS, all on the terms and conditions set forth below.

NOW, THEREFORE, in consideration of the above premises and the mutual covenants of the Parties to be faithfully performed, and for other consideration, the adequacy and receipt of which are hereby acknowledged, the Parties, intending to be legally bound, agree as follows:

1. DEFINITIONS

In addition to the terms defined above and elsewhere in this Agreement, the following terms when used herein with initial capital letters, shall have the respective meanings set forth in this Article 1.

1.1. __Affiliate__. The term "Affiliate" means and includes any Person that directly or indirectly controls, is controlled by, or is under common control with a Party as of the Effective Date of this Agreement, where "control" means: (i) the ownership of, or the power to vote, at least fifty percent (50%) of the voting stock, shares or interests of an entity, or (ii) the right to exercise management control, whether through ownership interest, contract, or otherwise.

1.2. __Change of Control__. The term "Change of Control" shall mean an event whereby any Person is subject to or engages in: (i) a merger, consolidation or other transaction or connected series of transactions that would result in the voting securities of such Person immediately prior to such transaction or connected series of transactions being held or beneficially owned by a Third Party after such transaction or connected series of transactions representing (either by remaining outstanding, or by being converted into, voting securities of the surviving entity) more than 50% of the combined voting power of the voting securities of such Person or the surviving entity; (ii) any transaction or connected series of transactions (including, without limitation, merger, consolidation, share exchange, sale, issuance, or transfer of voting securities; reclassification or recapitalization of capital stock; or dissolution, liquidation, or winding-up) in which a Third Party acquires more than 50% of the combined voting power of such Person's then outstanding voting securities; or (iii) any transaction or connected series of transactions with a Third Party by which the holders of the voting securities of such Person approve an agreement for the sale or disposition (or any transaction or connected series of transactions having a similar effect) of all or substantially all of the assets of the business unit to which this Agreement relates.

1.3. __Engine__. The term "Engine" shall mean any optic and/or electronic assembly which generates an electronic image of a barcode for use in an imaging based-barcode reader, mobile computer, or other device, whether or not enclosed in a housing.

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1.4. **2D Barcode Products**. The term "2D Barcode Products" shall mean any device or article of manufacture that is operable to decode at least one or more two-dimensional barcode symbologies into human-readable text. Two-dimensional ("2D") barcode symbologies include, but are not limited to, any two-dimensional barcode symbology defined by one or more standards settings organizations such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), and the Association for Automatic Identification and Mobility (AIM). For the avoidance of doubt, the term "2D Barcode Products" shall include Engines and other products that include a 2D image sensor and are capable of outputting a 2D image that may be used to decode a 2D barcode symbology into human-readable text.

1.5. **1D Barcode Products**. The term "1D Barcode Products" shall mean any device or article of manufacture that is operable to decode at least one or more 1D barcode symbologies into human-readable text but not operable to decode a 2D barcode symbology into human-readable text (and specifically excludes 2D Barcode Products) sold by a Party.

1.6. **Existing Product**. The term "Existing Product" shall mean any 2D Barcode Product made, had made, offered for sale, sold, imported, or owned by a Party in the U.S. prior to the Effective Date, [redacted]

1.7. **Improvement(s)**: The term "Improvement(s)" shall mean any: (i) revision, change, modification, alteration, or adaptation to an Existing Product (collectively, "Revision(s)") typically implemented during the natural evolution of a Barcode Technology product line during the Term; (ii) Revision(s) to size, shape, and external aesthetic features; (iii) Revisions made to fix bugs, correct errors, or made primarily to enhance reliability, service, maintenance or support of Licensed Products in a manner which would not be patentable; (iv) Revisions implementing any commercially available Third Party technologies (or non-patentable variations thereto) as the Third Party technology provider intends the technology to be used, or (v) where the implementation of the Third Party technology within Barcode Technology does not involve an inventive step. "Improvement" also includes any Revision that incorporates into any product offered by that Party any feature already present in any of the Party's other Existing Products, even if such incorporation produces a new combination of elements.

1.8. **Licensed Product**. The term "Licensed Product" shall mean any 2D Barcode Products that are imported into or made, sold, licensed, leased, or otherwise transferred in the United States by a Party during the License Period.

1.9. **License Period**. The term "License Period" shall mean the period between the Effective Date [redacted], inclusive.

1.10. **U.S. Patent Portfolio**. The term "U.S. Patent Portfolio" shall mean, with respect to a Party, all rights in any United States ("U.S.") patents, excluding any design patent directed to aesthetics ("Excluded Patent"), owned by such Party, and their respective successors and assigns, that is embodied in an Existing Product as of the Effective Date [redacted].

[redacted]

1.11. <u>Person</u>. The term "Person" shall mean an individual, corporation, partnership, limited liability company, joint venture, trust, trustee, unincorporated organization or other entity, including a governmental entity.

1.12. <u>Released Party</u>. The term "Released Party" shall mean: (i) a Party; and, as of the Effective Date: (ii) its Affiliates; and (iii) each of their respective parents, subsidiaries, joint ventures, divisions, equity holders, directors, officers, employees, agents, attorneys, partners, representatives, principals, successors, and assigns, and each of their respective developers, wholesalers, distributors, resellers, retailers, OEMs, and direct and indirect customers.

1.13. <u>Releasing Party</u>. The term "Releasing Party" shall mean: (i) a Party; (ii) its Affiliates; and (iii) and, to the extent Controlled by a Party or its Affiliates, each of their respective parents, subsidiaries, joint ventures, divisions, equity holders, directors, officers, employees, agents, heirs, trusts, trustees, past, present, contingent or remainder beneficiaries, settlors, partners, representatives, principals, successors, and assigns.

1.14. <u>Royalty-Bearing Product</u>. The term "Royalty-Bearing Product" shall mean any OPTICON Licensed Product or any product that can only be used with an OPTICON Licensed Product. Sales or other transfers solely between OPTICON and its Affiliates shall not be royalty-bearing.

1.15. <u>Third Party</u>. The term "Third Party" shall mean any Person other than a Party.

1.16. <u>Opticon Gross Revenue</u>. The term "Opticon Gross Revenue" shall mean all revenue, as determined in accordance with generally accepted accounting principles, received by OPTICON as a result of the sale, revenue generating use, or lease of a Royalty-Bearing Product. Opticon Gross Revenue shall not include sales or other excise taxes, and shall be reduced for returns and credits.

1.17. <u>Exhibits</u>. The following attached Exhibits are incorporated into this Agreement and form a part hereof:

Exhibit A:	*Joint Stipulation of Dismissal With Prejudice for DELAWARE ACTION*
Exhibit B:	*Joint Motion to Terminate ITC INVESTIGATION*
[redacted]	[redacted]
[redacted]	[redacted]

2. LICENSE AND COVENANT NOT TO SUE

2.1. <u>License</u>. Subject to the terms and conditions herein, each Party ("Licensor") hereby grants and shall cause its Affiliates to grant to the other Party ("Licensee") a non-exclusive, non-transferable (except as provided herein), non-sublicensable license to its U.S. Patent Portfolio to make, have made, use, sell, and offer for sale in, and import into the United States the Licensed Products during the License Period. [redacted]

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2.3. **Marking**. Upon written notice from a Party, the other Party shall make best efforts to mark (or virtually mark) all Licensed Products with the appropriate patents identified by the Party in accordance with all applicable statutory requirements, including 35 U.S.C. § 287.

2.4. **Covenant Not to Sue**. Subject to the terms and conditions herein, during the License Period of this Agreement, each Party shall not, and shall cause its Releasing Parties not to, bring or assist any Third Party in bringing any action, or to otherwise assert, or assist any Third Party in asserting, anywhere in the world, any claim, demand, cause of action or request for damages or other relief against the other Party, or their respective successors or assigns, or any of their manufacturers, suppliers, developers, resellers, distributors, wholesalers, and customers, each of the foregoing at any tier, for any infringement, alleged infringement or any other violation of any patents and/or patent applications for the manufacture, sale, offer to sell, lease, or importation of any 1D Barcode Products. [redacted]

2.5. **Rights by Implication**. Nothing contained herein shall be construed to provide any license or rights, other than those expressly granted herein, by implication, estoppel, or otherwise, such as an implied license, including any right to a license or to otherwise use any patent, patent application, trademark, service name, service mark, trade dress, trade secret or other intellectual property belonging to either Party as a result of the Covenant granted herein.

2.6. **No Foundry Rights.** For the avoidance of doubt, the license set forth in Section 2.1 and the covenant not to sue set forth in Section 2.4 shall not apply to any products that OPTICON or any OPTICON Affiliate makes, has made, uses, sells, offers for sale in, and imports into the United States as a foundry on behalf of a third party. The Licensed Products shall in no event include any products manufactured, produced, or provided by OPTICON or an OPCTION Affiliate according to the design requirements or specifications of a third party.

3. **MUTUAL RELEASES AND DISMISSAL**

3.1. **Release**. Subject to the terms and conditions herein, each Party, on behalf of itself and its Releasing Parties, hereby releases, acquits, and forever discharges the other Party and its Released Parties from any and all claims or liability of any kind whatsoever, known or

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unknown, suspected or unsuspected, of any nature whatsoever, whether in law or in equity, in the United States or any foreign country, from the beginning of time to the Effective Date. Nothing in this Section 3.1 shall be interpreted as releasing either Party from its obligations set forth in this Agreement, from claims or causes of action arising out of any breach of those obligations, or from claims arising after the Effective Date. Notwithstanding the foregoing, it is expressly understood by the Parties that the release granted to OPTICON herein is expressly conditioned upon and subject to OPTICON making [redacted].

3.2. __**Dismissal**__. No later than 10 days from the date of the last execution of this Agreement: (i) the Parties shall file a joint motion to terminate the ITC INVESTIGATION on the basis of this Agreement pursuant to 19 C.F.R. § 210.21(b)(1) in the form attached hereto as **Exhibit B**; and (ii) file a joint stipulation of dismissal with prejudice in the DELAWARE ACTION pursuant to Federal Rule of Civil Procedure 41(a)(1)(A)(ii) in the form attached hereto as **Exhibit A**, after counsel for a Party enters an appearance on behalf of the Party if that Party has not responded to the complaint or otherwise appeared. Each Party shall bear its own costs, expenses, and attorneys' fees in connection with this Agreement, the ITC INVESTIGATION and the DELAWARE ACTION.

3.3. __**Claims and Defenses Preserved**__. Notwithstanding the foregoing, nothing in this Agreement shall prejudice any claims and defenses that a Party may assert in the event that the other Party asserts or threatens to assert claims of patent infringement against the non-asserting Party, including, but not limited to, claims and defenses of non-infringement, invalidity or unenforceability. A Party may assert these claims or defenses by any legal means, including, but not limited to, an action for declaratory relief or judgment, a petition for a patent reexamination or review by the United States Patent and Trademark Office, and/or as defenses in an action brought by the other Party claiming infringement.

3.4. __**Waiver of Section 1542 Of The California Civil Code**__. The Parties to this Agreement hereby expressly waive the provisions of Section 1542 of the California Civil Code and any similar provision of the statutory or non-statutory law of any other jurisdiction. Section 1542 of the California Civil Code states as follows:

> A GENERAL RELEASE DOES NOT EXTEND TO CLAIMS WHICH THE CREDITOR DOES NOT KNOW OR SUSPECT TO EXIST IN HIS FAVOR AT THE TIME OF EXECUTING THE RELEASE, WHICH IF KNOWN BY HIM MUST HAVE MATERIALLY AFFECTED HIS SETTLEMENT WITH THE DEBTOR.

4. PAYMENTS AND OTHER CONSIDERATION

4.1. __**Waiver of Past Damages**__. Each Party, on its own behalf and on behalf of its Releasing Parties, hereby waives all damages of any kind or nature arising out of or related to any patent infringement occurring prior to the Effective Date.

4.2. __**OPTICON's [redacted] Payment**__. In consideration of the termination of the ITC INVESTIGATION and the dismissal with prejudice of the DELAWARE ACTION, as well as the Release set forth in Section 3.1, OPTICON shall pay HONEYWELL INTERNATIONAL [redacted]

[redacted]

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4.3. **OPTICON'S Royalties to HONEYWELL for HONEYWELL'S U.S. Patent Portfolio.** In consideration of the license granted by HONEYWELL to OPTICON pursuant to Section 2.1, OPTICON shall pay to HONEYWELL INTERNATIONAL a royalty of [redacted] OPTICON shall make each royalty payment due under this Section 4.3 to HONEYWELL INTERNATIONAL no later than the forty-fifth (45th) day following the end of each calendar quarter during the License Period.

4.4. **Method of Payment.** OPTICON shall pay the quarterly royalty payments set forth in Section 4.3 and the payments due under Section 4.2 to HONEYWELL INTERNATIONAL by wire transfer as follows:

[redacted]

4.5. **Royalty Reports.** On the date of each quarterly royalty payment during the License Period, OPTICON shall deliver to HONEYWELL INTERNATIONAL a report showing for such calendar quarter: (i) a list of all separately identifiable types (i.e., by model numbers or equivalent) of units of Royalty-Bearing Products first sold or leased during such calendar quarter and a list of all units of Royalty-Bearing Products first used by OPTICON in the provision of services to a Third Party during such calendar quarter; (ii) the quantity of such units of each type, including deductions for returns; and (iii) the derivation of the amount payable to HONEYWELL INTERNATIONAL from the foregoing information ("**Quarterly Report(s)**"). OPTICON shall maintain complete and accurate records containing the data from which amounts due to HONEYWELL INTERNATIONAL under this Agreement can be calculated for six (6) years from the date of each Quarterly Report. HONEYWELL INTERNATIONAL, through an independent certified public accounting firm, shall have the right, at HONEYWELL INTERNATIONAL's expense, to audit OPTICON's records for the purpose of determining the accuracy of any royalty payments due and payable hereunder for the six (6) year period immediately preceding the audit; provided that HONEYWELL INTERNATIONAL provides OPTICON with reasonable prior notice, and such audit is conducted during OPTICON's normal business hours. Such audits may be conducted no more than one (1) time per two (2) calendar years. Should an audit show a royalty underpayment for any calendar year in excess of five percent (5%) of the

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royalties paid for such calendar year, OPTICON shall reimburse HONEYWELL INTERNATIONAL for the reasonable cost of such audit. OPTICON shall have the right to require that the independent certified public accounting firm HONEYWELL INTERNATIONAL retains to perform the audit enter into a confidentiality agreement preventing the disclosure of confidential cost and pricing data and other competition sensitive information to HONEYWELL INTERNATIONAL and Third Parties.

4.6. __Late Fee__. In the event a Party fails to make any payment due hereunder (including late charges) when and as required, that Party shall pay the other a late charge of one and a half percent (1.5%) per month (or such lower rate if required by applicable law) on any amounts not paid when due. Such late charge will accrue from the first day after the payment was due. The late charge will be due and payable on the last day of each month until full payment of all amounts due have been made. Partial payments will be applied first to overdue royalty payments and then to late charges.

4.7. __Collection__. In the event a Party must institute an action to collect any overdue payments, that Party shall be entitled to its fees and costs incurred with respect to such an action. Prior to the institution of any such action, the Party shall provide the other with Notice of the overdue payments and ten (10) days to satisfy any outstanding obligation.

4.8. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

5. REPRESENTATIONS, WARRANTIES, AND COVENANTS

5.1. <u>Representations and Warranties Of OPTICON</u>. OPTICON makes the following representations and warranties: (i) it has the full corporate power and authority to execute and deliver this Agreement and to consummate the transactions contemplated hereby; (ii) the execution of this Agreement by OPTICON and the performance of its obligations hereunder will not violate any agreement, whether written or oral, to which OPTICON or any of its Affiliates is a party; (iii) OPTICON has not assigned to anyone any matters released by OPTICON pursuant to Section 3.1 of this Agreement; (iv) OPTICON has not assigned to anyone any future claims it may have against HONEYWELL or its Affiliates; (v) OPTICON has not acquired any entities within twelve (12) months prior to the Effective Date; and (vi) OPTICON has not sold itself or agreed to sell itself to a Third Party within twelve (12) months prior to the Effective Date.

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5.2. **Representations and Warranties of HONEYWELL**. HONEYWELL makes the following representations and warranties: (i) HONEYWELL has full corporate power and authority to execute and deliver this Agreement and to consummate the transactions contemplated hereby; (ii) the execution of this Agreement by HONEYWELL and the performance of its obligations hereunder will not violate any agreement, whether written or oral, to which HONEYWELL or any of its Affiliates is a party; and (iii) HONEYWELL has not assigned to anyone any matter released by HONEYWELL pursuant to Section 3.1 of this Agreement.

5.3. **OPTICON's Covenant Not to Challenge**. OPTICON covenants that it will not challenge, and shall cause its Releasing Parties and any licensees not to challenge, the validity, scope or enforceability of any of OPTICON's or its Affiliates' patents, or any other patent or patent application of OPTICON or its Affiliates, relating to Barcode Technology in whole or in part, or [redacted]

5.4 **HONEYWELL'S Covenant Not to Challenge**. HONEYWELL covenants that it will not challenge, and shall cause its Releasing Parties and any licensees not to challenge, the validity, scope or enforceability of any of OPTICON's or its Affiliates' patents or any other patent or patent application of OPTICON or its Affiliates, relating to Barcode Technology in whole or in part, during the License Period unless OPTICON contends that the Release OPTICON granted HONEYWELL under Section 3.1 is void due to a material breach by HONEYWELL of this Agreement and OPTICON seeks to enforce its patent rights.

6. CONFIDENTIALITY

6.1. **Confidentiality**. All information provided pursuant to this Agreement, including the terms of this Agreement, shall be regarded as confidential information ("**Confidential Information**"). The Parties shall use the Confidential Information only for the purposes set

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forth herein. Each Party shall safeguard the Confidential Information of the other Party with the same degree of care that it utilizes to safeguard its own proprietary information of a similar character, but in no event shall it use less than reasonable care to safeguard such Confidential Information. A Party shall not disclose any Confidential Information, except: (i) to its Affiliates, provided that the recipients are informed of, and obligated to maintain, the confidentiality of the Confidential Information; (ii) with the prior written consent of the other Party; (iii) to Third Parties as may be required under applicable law, regulation or order of a governmental authority of competent jurisdiction (including by the rules or regulations of the United States Securities and Exchange Commission or similar regulatory agency in a country other than the United States or of any stock exchange or NASDAQ); (iv) to Third Parties during the course of litigation if required in discovery so long as the disclosure of such Confidential Information is made on a confidential basis under an appropriate protective order entered in the litigation, or non-disclosure agreement with similar provisions, and provided that the producing Party gives prior written notice to the other Party; (v) in any pleadings in connection with the enforcement of this Agreement, with the understanding that any such pleading shall be filed confidentially or under seal to the extent allowable by the applicable court or tribunal; or (vi) in confidence to a Party's lenders and potential lenders; acquirers and potential acquirers; bankers; investment bankers; investors and potential investors; consultants; accountants; tax advisors; auditors; and attorneys for the purposes of seeking professional services, investment monies, or acquisition, provided that the recipients are informed of, and obligated to maintain, the confidentiality of the Confidential Information. Each Party shall be responsible for its Affiliates' compliance with this Article 6. Confidential Information shall not include information that: (i) was already known by the receiving Party or its Affiliates, other than under an agreement of secrecy or non-use, at the time of its disclosure; (ii) has passed into the public domain prior to or after its disclosure, otherwise than through any act or omission attributable to the receiving Party or its Affiliates; (iii) was subsequently disclosed to the receiving Party or its Affiliates, other than pursuant to an agreement of secrecy or non-use, by a Third Party that had not acquired the information under an obligation of confidentiality; or (iv) was independently developed by the receiving Party or its Affiliates.

6.2. **Public Comment**. Except as provided in this Section 6, no Party shall issue any press release, public announcement, news media response or other form of release of information concerning the settlement and dismissal of the LEGAL ACTIONS or the terms of this Agreement without the prior written consent of the other Party, which consent shall not be unreasonably withheld or delayed. No Party shall make any public comments regarding the nature and quality of the settlement of the LEGAL ACTIONS (i.e., whether it is favorable or not to a Party). Notwithstanding the foregoing to the contrary, the Parties and their representatives and counsel may state that the LEGAL ACTIONS have been settled through a confidential agreement between the Parties. No Party shall make any disparaging public comments or disparaging comments relating to the disputes between the Parties; but for the avoidance of doubt the Parties are not restricted from comments that would be typical and appropriate by Parties that continue to sell competing products, including product comparisons and descriptions of the relative benefits and qualities of, for example, the price, features and accessories for competing products.

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7. TERM AND TERMINATION

7.1. Term. This Agreement shall commence as of the Effective Date and shall expire at the end of the License Period, unless earlier terminated in accordance with Section 7.2.

7.2. Termination. This Agreement may not be terminated except: (i) by mutual written agreement of the Parties; or (ii) by HONEYWELL in the event OPTICON fails to pay undisputed amounts due and owing under this Agreement, which such failure to pay is not cured within thirty (30) days of OPTICON's receipt of written notice of such failure to pay.

8. DISCLAIMERS/LIMITATION OF LIABILITY

EXCEPT AS OTHERWISE EXPRESSLY SET FORTH HEREIN, NEITHER PARTY MAKES ANY REPRESENTATIONS OR EXTENDS ANY WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, THE ABSENCE OF ANY LATENT OR OTHER DEFECTS, WHETHER OR NOT DISCOVERABLE, AND NON-INFRINGEMENT OF ANY THIRD PARTY RIGHTS. NOTHING IN THIS AGREEMENT SHALL BE CONSTRUED AS A REPRESENTATION MADE OR WARRANTY GIVEN BY EITHER PARTY THAT THE OTHER PARTY'S PRACTICE OF THE LICENSE GRANTED TO IT HEREUNDER WILL NOT INFRINGE, MISAPPROPRIATE OR OTHERWISE VIOLATE THE PATENT OR OTHER INTELLECTUAL PROPERTY RIGHT OF ANY THIRD PARTY. IN NO EVENT SHALL EITHER PARTY BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND, INCLUDING ECONOMIC DAMAGE OR INJURY TO PROPERTY OR LOST PROFITS, REGARDLESS OF WHETHER EITHER PARTY IS ADVISED OF SUCH OR SHOULD HAVE REASON TO KNOW OR IN FACT SHALL KNOW OF THE POSSIBILITY OF THE FOREGOING. NEITHER PARTY SHALL HAVE ANY LIABILITY WHATSOEVER TO THE OTHER PARTY OR ANY OTHER PERSON FOR OR ON ACCOUNT OF ANY INJURY, LOSS OR DAMAGE OF ANY KIND OR NATURE, SUSTAINED BY OR ANY DAMAGE ASSESSED OR ASSERTED AGAINST, OR ANY OTHER LIABILITY INCURRED BY OR IMPOSED UPON, THE PARTY OR ANY OTHER PERSON, ARISING OUT OF, IN CONNECTION WITH OR RESULTING FROM A THIRD-PARTY CLAIM RELATING TO THE PRODUCTION, USE, SALE, LEASE, DISTRIBUTION OR OTHER TRANSFER OF ANY PRODUCT COVERED BY THE TERMS OF THIS AGREEMENT OR THE PROVISION OF SERVICES TO ANY THIRD PARTY USING PRODUCTS COVERED BY THE TERMS OF THIS AGREEMENT.

9. MISCELLANEOUS

9.1. Non-Agency. Nothing in this Agreement is intended or shall be deemed to constitute a partnership, agency, employer-employee, or joint venture relationship between the Parties.

9.2. Entire Agreement, Amendments, And Waivers. This Agreement and its Exhibits, constitute and contain the entire agreement among the Parties respecting the subject matter hereof, and supersede any and all prior negotiations, conversations, correspondence, understandings, and letters. This Agreement may be amended, modified, and/or one or more provisions hereof waived only by a written instrument signed by the Parties. No delay or omission by any Party in exercising any right or power arising from any default by another Party shall be construed as a waiver of such default, nor shall any single or partial exercise

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thereof preclude any further exercise thereof or the exercise of any other right or power arising from any default by a Party. No waiver of any breach of any covenant or other condition shall be construed to be a waiver of or consent to any previous or subsequent breach of the same or of any other covenant or condition.

9.3. **Severability**. In the event a part or provision of this Agreement is held to be invalid or unenforceable or in conflict with law for any reason, the Parties shall replace any such part or provision with a valid provision which most closely approximates the intent and economic effect of the invalid or unenforceable provision as of the Effective Date.

9.4. **Construction**. This Agreement shall be construed as if equally drafted by the Parties hereto. The article and section headings to this Agreement are for convenience only and are to be of no force or effect in construing and interpreting the provisions of this Agreement. The term "including" means "including without limitation."

9.5. **Governing Law, Choice of Forum, And Consent To Jurisdiction**. This Agreement shall be governed by and construed under applicable federal law and the laws of the State of Delaware, notwithstanding any conflict of law provisions. Any legal action or proceeding with respect to this Agreement, but not any actions with respect to patent infringement disputes, shall be brought in the appropriate state or federal courts of the State of North Carolina. The Parties hereby waive any objection they may now or hereafter have to the venue of any such action in the said court(s), and further waive any claim they may now or hereafter have that any such action brought in said court(s) has been brought in an inconvenient forum. Each of the Parties hereto consents to the exclusive jurisdiction of the State of North Carolina, over any suit, action or proceeding arising out of or relating to this Agreement.

9.6. **Notices And Acceptance**. Any notice required or permitted under this Agreement shall be given in writing and shall be sent via overnight carrier to the following addresses.

Notices to OPTICON shall be sent to:

[redacted]
Opto Electronics Co., Ltd.
4-12-17 Tsukagoshi
Warabi-shi, Saitama 335-0002
Japan

With a copy to:

Ryan Goldstein
Quinn Emanuel Urquhart & Sullivan
Ark Mori Bldg., 11F
1-12-32 Akasaka
Minato-ku, Tokyo 107-6011
Japan
ryangoldstein@quinnemanuel.com

[redacted]

Notices to HONEYWELL shall be sent to:

[redacted]
300 S. Tryon Street, Suite 500
Charlotte, NC 28202
[redacted]

With a copy to:

S. Benjamin Pleune
Bank of America Plaza
101 South Tryon Street
Suite 4000
Charlotte, NC 28280
ben.pleune@alston.com

This Agreement may be signed in counterparts, including via electronic signature. This Agreement shall become binding upon exchange of electronically-signed, faxed or scanned signatures.

9.7. **Assignment.** The rights granted to each Party pursuant to this Agreement are personal to the receiving Party and may only be assigned as described in this section. For purposes of this Agreement, a Change of Control shall be deemed an assignment. Except as specified in this Section 9.7, no Party may assign or otherwise transfer this Agreement or the licenses or covenants not to sue granted hereunder without the prior written consent of the other Party, which consent shall not be unreasonably withheld. [redacted]

[redacted]

[redacted]

9.8. **Dispute Resolution**. Before any Party can commence any action in court against the other Party arising out of or relating to this Agreement, such Party shall first give notice to the other Party of the basis for the dispute and must seek to resolve such dispute through conferring with the other Party for a period of thirty (30) days. If agreement is not reached within thirty (30) days after notice or such further period as the Parties may agree, only then may a Party bring such dispute before a court. In any such action, the Parties shall have all remedies available to them under applicable law.

9.9. **No Admission**. This Agreement represents the settlement of disputed claims asserted by each Party. Nothing contained herein is or is to be construed as an admission or evidence of liability, including an admission of infringement, enforceability or validity of any intellectual property, as notice sufficient to support an allegation of willful infringement, or of anticompetitive or unfair competition conduct, on the part of either Party.

9.10. **Survival**. Articles 3 (Mutual Releases and Dismissal), Article 4 (Payments and Other Consideration) to the extent not paid for amounts due and owing, 5 (Representations, Warranties and Covenants), 6 (Confidentiality), 8 (Disclaimers/Limitation of Liability), and 9 (Miscellaneous) of this Agreement shall survive the expiration or termination of this Agreement, unless specified herein to the contrary.

9.11. **Licensee's Retained Rights**. The licensed rights and the covenants not to sue granted herein shall be deemed licenses of "intellectual property" for purposes of the United States Code, Title 11, Section 365(n). In the event of a licensor's bankruptcy and a subsequent rejection or disclaimer of this Agreement by a bankruptcy trustee or by such licensor as a debtor-in-possession, whether under the laws of the United States or elsewhere, or in the event of a similar action under applicable law, the licensed Party and its respective Affiliates may elect to retain their rights granted in Article 2, subject to and in accordance with the provisions of the United States Code, Title 11, Section 365(n) or other applicable law.

IN WITNESS WHEREOF, each of the Parties hereto, by its duly authorized representative, has executed this Agreement effective as of the Effective Date first set forth above.

[redacted]

Brian S. Kudick
Vice President & General Counsel
Honeywell | Safety & Productivity Solutions
300 S. Tryon Street, Suite 500
Charlotte, NC 28202

[redacted]

Katsutoshi Ishikawa
Executive Director
Opto Electronics Co., Ltd.
4-12-17 Tsukagoshi
Warabi-shi, Saitama 335-0002
Japan

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Public Version

Exhibit A

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Public Version

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

HONEYWELL INTERNATIONAL, INC., HAND HELD PRODUCTS, INC., and METROLOGIC INSTRUMENTS, INC., **Plaintiffs,** **v.** **OPTICON, INC., OPTICON SENSORS EUROPE B.V., and OPTO ELECTRONICS CO., LTD.,** **Defendant.**	**C.A. No. 1:19-cv-01019-CFC**

STIPULATION OF DISMISSAL WITH PREJUDICE

Pursuant to Federal Rule of Civil Procedure 41(a)(1)(ii), Plaintiffs Honeywell International Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. and Defendants Opticon, Inc., Opticon Sensors Europe B.V., and OPTO Electronics Co., Ltd., by their undersigned counsel, hereby stipulate and agree that this action may be dismissed and is hereby dismissed, with prejudice, including all claims and counterclaims, with each party to bear its own costs and attorneys' fees.

Public Version

Dated: February [[____]], 2020

Respectfully submitted,

/draft
Steven J. Balick (#2114)
Andrew C. Mayo (#5207)
500 Delaware Avenue, 8th Floor
P.O. Box 1150
Wilmington, DE 19899
(302) 654-1888
sbalick@ashbygeddes.com
amayo@ashbygeddes.com

Attorneys for Plaintiffs Honeywell International Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc.

/draft
Anne Shea Gaza (No. 4093)
Samantha G. Wilson (No. 5816)
YOUNG CONAWAY STARGATT & TAYLOR, LLP
Rodney Square 1000 North King Street
Wilmington, DE 19801
(302) 571-6600
agaza@ycst.com
swilson@ycst.com

Attorneys for Defendants Opticon, Inc., Opticon Sensors Europe B.V., and Opto Electronics Co., Ltd.

SO ORDERED this ___ day of ______ 2020.

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Exhibit B

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THE UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

Before The Honorable MaryJoan McNamara
Administrative Law Judge

In the Matter of **CERTAIN BARCODE SCANNERS, SCAN ENGINES, PRODUCTS CONTAINING THE SAME, AND COMPONENTS THEREOF**	**Investigation No. 337-TA-1165**

JOINT MOTION TO TERMINATE INVESTIGATION NO. 337-TA-1165 ON THE BASIS OF A SETTLEMENT AGREEMENT

Complainants Honeywell International Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. (collectively, "Honeywell") and Respondents Opticon, Inc., Opticon Sensors Europe B.V., OPTO Electronics Co., Ltd., and Hokkaido Electronic Industry Co., Ltd. (collectively, "Opticon") respectfully request that Investigation No. 337-TA-1165 be terminated pursuant to 19 U.S.C. § 1337(c) and 19 C.F.R. § 210.21(b) in view of a confidential License and Settlement Agreement ("Agreement") between Honeywell and Opticon. The Agreement resolves all of the issues in dispute in this investigation.

The Agreement has been executed by Honeywell and Opticon and is fully effective between them. The Agreement is attached hereto as Exhibit 1, and it contains Confidential Business Information within the meaning of 19 C.F.R. § 201.6. Accordingly, Honeywell and Opticon request that the Agreement be treated as Complainants' and Respondent's Confidential Business Information under the Protective Order in this proceeding. A redacted, non-confidential

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version of the Agreement is attached as Exhibit 2 and will be filed with the public version of this Joint Motion to Terminate.

The Agreement resolves the dispute between Honeywell and Opticon in this investigation. The Agreement reflects the entire and only agreement between Honeywell and Opticon regarding the subject matter of this proceeding. There are no other agreements, written or oral, express or implied, between Honeywell and Opticon regarding the subject matter of this proceeding.

In view of the attached Agreement, there no longer exists a basis upon which to continue this investigation. Furthermore, termination of this proceeding pursuant to the Agreement poses no threat to the public interest. Indeed, it is in the interest of the public and administrative economy to grant this motion. Commission policy and the public interest generally favor settlements, which preserve resources for both the Commission and the private parties, and termination based on a settlement agreement is routinely granted. *See, e.g.*, *Certain Mobile Telephones and Wireless Communications Devices Featuring Digital Cameras,* , Inv. No. 337-TA-663, Order No. 54 at 2-3 (Jan. 15, 2010); *Certain Synchronous Dynamic Random Access Memory Devices, Microprocessors, and Products Containing Same*, Inv. No. 337-TA-431, Order No. 11 at 2 (July 12, 2000); *Certain Integrated Circuit Chipsets*, Inv. No. 337-TA-428, Order No. 16 at 5 (Aug. 22, 2000).

GROUND RULE 2.2 CERTIFICATION

This is a joint motion on behalf of the parties and thus no party opposes.

CONCLUSION

For the reasons set forth above, Honeywell and Opticon respectfully request that the ALJ and Commission terminate Investigation No. 337-TA-1165 in its entirety in accordance with the provisions of 19 U.S.C. § 1337(c) and 19 C.F.R. § 210.21(b) based on the Agreement.

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Public Version

Dated: February [[___]], 2020

By: */s/ M Scott Stevens* M. Scott Stevens **ALSTON & BIRD LLP** 950 F Street NW Washington, DC 20004 Telephone: (202) 239-3025 Facsimile: (704) 444-1035 S. Benjamin Pleune Stephen R. Lareau Adam J. Doane Nicholas C. Marais Lauren N. Bond **ALSTON & BIRD LLP** 101 South Tryon Street, Suite 4000 Charlotte, NC 28280 Telephone: (704) 444-1098 Facsimile: (704) 444-1698 Yuri Mikulka **ALSTON & BIRD LLP** 333 South Hope Street, 16th Floor Los Angeles, CA 90071 Telephone: (213) 576-1026 *Counsel for Complainants Honeywell International, Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc.*	By: */s/ Jeffrey S. Gerchick* S. Alex Lasher Jeffrey S. Gerchick Jared W. Newton K. Kevin Chu QUINN EMANUEL URQUHART & SULLIVAN, LLP 1300 I Street, NW, Suite 900 Washington, D.C. 20005 Tel.: (202) 538-8000 Richard W. Erwine Kevin Jang QUINN EMANUEL URQUHART & SULLIVAN, LLP 51 Madison Ave. New York, NY 10010 Tel.: (212) 849-7000 Steven Cherny Patrick D. Curran QUINN EMANUEL URQUHART & SULLIVAN, LLP 111 Huntington Ave, Suite 520 Boston, MA 02199 Tel.: (617) 712-7100 Ryan S. Goldstein York M. Faulkner QUINN EMANUEL URQUHART & SULLIVAN, LLP Hibiya U-1 Bldg., 25F 1-1-7, Uchisaiwai-cho Chiyoda-ku, Tokyo, 100-0011 Japan Tel.: +81 3 5510 1711 Koichiro Minamino MINAMINO LAW OFFICE, PLLC 1300 I Street, N.W. Suite 900 Washington, DC 20005 Tel.: (202) 777-3638 *Counsel for Respondents Opticon, Inc., Opticon Sensors Europe B.V.,*

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Public Version

	OPTO Electronics Co., Ltd.,and Hokkaido Electronic Industry Co., Ltd.

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Public Version

Exhibit C

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Public Version

EXHIBIT C

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Public Version

EXHIBIT C

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Public Version

EXHIBIT C

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Exhibit D

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Public Version

EXHIBIT D

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CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this day, a true and correct copy of the foregoing document was served by the indicated means to the persons at the addresses below:

The Honorable Lisa R. Barton Secretary to the Commission **U.S. International Trade Commission** 500 E Street, S.W., Room 112 Washington, DC 20436	Via Electronic Filing (EDIS)
The Honorable MaryJoan McNamara Administrative Law Judge **U.S. International Trade Commission** 500 E Street, SW Washington, D.C. 20436 Jae B. Lee Attorney Advisor **U.S. International Trade Commission** 500 E Street, S.W. Washington, DC 20436	Via Hand Delivery (2 copies) to be delivered by the next Business Day Via Electronic Mail to: McNamara337@usitc.gov Jae.Lee@usitc.gov
S. Alex Lasher Jeffrey S. Gerchick Jared W. Newton K. Kevin Chu QUINN EMANUEL URQUHART & SULLIVAN, LLP 1300 I Street, NW, Suite 900 Washington, D.C. 20005 Tel.: (202) 538-8000 Richard W. Erwine Kevin Jang QUINN EMANUEL URQUHART & SULLIVAN, LLP 51 Madison Ave. New York, NY 10010 Tel.: (212) 849-7000 Steven Cherny Patrick D. Curran QUINN EMANUEL URQUHART & SULLIVAN, LLP 111 Huntington Ave, Suite 520 Boston, MA 02199	Electronic Mail to: optoitc@quinnemanuel.com mick@minaminolaw.com

Tel.: (617) 712-7100 Ryan S. Goldstein York M. Faulkner QUINN EMANUEL URQUHART & SULLIVAN, LLP Hibiya U-1 Bldg., 25F 1-1-7, Uchisaiwai-cho Chiyoda-ku, Tokyo, 100-0011 Japan Tel.: +81 3 5510 1711 Koichiro Minamino MINAMINO LAW OFFICE, PLLC 1300 I Street, N.W. Suite 900 Washington, DC 20005 Tel.: (202) 777-3638 *Counsel for Respondents Opticon, Inc., Opticon Sensors Europe B.V., OPTO Electronics Co., Ltd.,and Hokkaido Electronic Industry Co., Ltd.*	

Date: February 18, 2020

/s/ *M. Scott Stevens*
M. Scott Stevens

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION

HONEYWELL INTERNATIONAL, INC., HAND HELD PRODUCTS, INC., METROLOGIC INSTRUMENTS, INC., *Plaintiffs,* v. OPTO ELECTRONICS CO., LTD., *Defendant.*	Civil Action No.

EXHIBIT B TO COMPLAINT

OPTICON

Cabled Scanners

L-46R

Laser scanner

The L-46R features next generation scanning technology along with the perfect combination of performance, durability and reliability.
It automates a variety of processes and is designed and built for all day, everyday use.

Highlights

- Ergonomic design delivering the perfect combination of performance, durability and reliability
- Ideal solution for a variety of applications in retail, warehousing, distribution, healthcare, transportation and logistics
- 100 scans/second high speed laser scanner
- Durable—survives 1.8 meter drop to concrete
- IP42 rating against dust and moisture
- Trigger modes: manual, auto-trigger and stand detection
- Communication interface: USB or RS232
- Interchangeable cables, making it easy to switch between USB or RS232
- Antimicrobial coating optional
- Available in black or white
- Stand included
- Backed by a two year warranty

L-46R

Product Specifications

Operation
CPU: 32-bit

Operating indicators
Visual: 1 LED
Non-visual: buzzer, vibrator (optional)

Operating keys
Entry options: 1 scan key

Communication
RS232C: DB9 pin (with external power supply), D-SUB9 pson pin 9 (optional)
USB: ver. 2.0, HID/VCP, USB-A connector

Power
Voltage requirement: 5V ±10%
Current consumption: 155 mA typical

Barcode scanner optics
Light source: red laser, 650 nm
Scan method: 650 nm red laser diode, bi-directional scanning
Scan rate: Up to 100 scans / second
Trigger mode: Manual, auto-trigger, stand detection
Reading pitch angle: ± 35º
Reading skew angle: -50º to 8º, 8º to +50º
Reading tilt angle: ± 20º
Curvature: R≥15 mm (EAN-8), R≥20 mm (EAN13)
Min. resolution at PCS 0.9: 0.076 mm
Min. PCS value: 0.2
Depth of field at code 39:
10 - 60 mm (0.127 mm) / 0.39 - 2.36 in (5 mil)
5 - 90 mm (0.15 mm) / 0.2 - 3.54 in (6 mil)
5 - 200 mm (0.25 mm) / 0.2 - 7.87 in (9.84 mil)
0 - 495 mm (0.5 mm) / 0 - 19.49 in (20 mil)
20 - 895 mm (1.0 mm) / 0.79 - 35.24 in (39 mil)

Supported symbologies
Barcode (1D): UPC-A, UPC-A Add-on, UPC-E, UPC-E Add-on, EAN-13, EAN-13 Add-on, EAN-8, EAN-8 Add-on, Code 39, NW-7 (Codabar), Industrial 2 of 5, Interleaved 2 of 5, Code 93, Code 128, GS1-128, MSI/Plessey-UK/Plessey, Matrix 2of5, Code 11, GS1 DataBar, GS1 DataBar Limited, GS1 DataBar Expanded, TELEPEN
2D code: PDF417, MicroPDF417

Durability
Temperature in operation: -5 to 50 ºC / 23 to 122 ºF
Temperature in storage: -30 to 60 ºC / 22 to 140 ºF
Humidity in operation: 5% to 90% (non-condensing)
Humidity in storage: 5% to 90% (non-condensing)
Ambient light immunity: Fluorescent 4,000 lx, direct sun 80,000 lx
Max drop test: 1.8 m / 6 ft drop onto concrete surface
Vibration test: 10 - 100Hz with 2G for 1 hour
Protection rate: IP42

Physical
Dimensions Scanner (W x H x D): 105.4 x 153.4 x 60 mm / 4.15 x 6.04 x 2.36 in
Weight body: Ca. 111 g / 3.9 oz (excl. cable)
Dimensions Stand (W x H x D): 53 x 112 x 73 mm / 2.09 x 4.41 x 2.87 in
Weight Stand: Ca. 365 g / 12.9 oz
Case: Black or White

Regulatory & safety
Product compliance: CE, FCC, VCCI, RoHS, IEC/EN60825-1:2014, JIS C 6802:2014, CDRH Class II, EN55032, EN61000

Items
Enclosed: Stand

Models
Interface versions: RS232, USB

OPTICON www.opticon.com

_L-46R_04.2019

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION
3:21CV506

HONEYWELL INTERNATIONAL, INC., HAND HELD PRODUCTS, INC., and METROLOGIC INSTRUMENTS, INC.,	)	
Plaintiffs,	)	
vs.	)	ORDER
OPTICON ELECTRONICS CO., LTD.,	)	
Defendant.	)	

This matter is before the Court upon Plaintiffs' Motion to Dismiss Defendant's Counterclaims. A hearing was held in this matter on April 11, 2022.

I. FACTUAL BACKGROUND

Honeywell International, Inc. ("Honeywell") and Opto Electronics Co., Ltd ("Opticon") are competitors in the manufacture and sale of barcode readers. On May 31, 2019, Honeywell filed complaints for patent infringement against Opticon. (Compl. ¶10). Honeywell and Opticon subsequently entered into a License and Settlement Agreement (the "Agreement") which resolved the dispute. *Id*. at ¶13. Under the Agreement, Opticon received a license to Honeywell's "U.S. Patent Portfolio." (Agreement, Doc. No. 1-1, § 2.1). In exchange for the license, Opticon was required to make ongoing payments of a specified percentage of Opticon's gross revenue derived from the sales of "2D Barcode Products" in the United States. *Id*. at § 4.

Under the Agreement, Opticon represented and warranted the amount of its Gross Revenue of "2D Barcode Products." *Id*. at § 5.1. Opticon agreed to make an additional payment if it was determined that it under-reported its Gross Revenue. *Id*. The Agreement also contains

certain audit provisions allowing Honeywell to verify the accuracy of Opticon's representations regarding its revenues. (Compl. ¶ 20). After invoking the audit provision, Honeywell learned that Opticon's revenues from sales of 2D Barcode Products were tens of millions of dollars more than Opticon represented in the Agreement, in part because Opticon had excluded certain 2D Barcode Products from its calculations. *Id*. at ¶¶ 22, 23.

Honeywell filed the current action against Opticon alleging breach of contract. Opticon filed its Answer, Affirmative Defenses, and Counterclaims to the Complaint, asserting claims for unfair and deceptive trade practices in violation of N.C. Gen. Stat. §75-1.1 (the "UDTPA"), declaration of patent unenforceability for patent misuse, and breach of implied covenant of good faith and fair dealing. *See* Doc. No. 17. OPTICON alleges that it "timely and fully paid all patent royalties due and owing on its barcode readers 'that include a 2D image sensor'" (Counterclaims, ¶ 42) and that Honeywell's claim "wrongly asserts" that certain identified products are "royalty bearing '2D Barcode Products' under the Agreement." *Id*. at ¶ 44.

The crux of the dispute between the Parties focuses on their disagreement as to what constitutes royalty bearing 2D Barcode Products. Honeywell's position is that certain of Opticon's laser scanning barcode products are included. Opticon contends that they are not. In its Counterclaim, Opticon alleges that Honeywell intentionally and objectively through its conduct led Opticon to believe the royalty payment terms of the Agreement Honeywell seeks to enforce applied only to Opticon's 2D image sensor barcode products, and not to Opticon's 1D laser scanning barcode products. *See* Doc. No. 14, ¶¶ 21-34.

Honeywell now moves to dismiss Opticon's counterclaims pursuant to Rule 12(b)(6) of the Federal Rules of Civil Procedure.

II. DISCUSSION

A. Standard of Review

"To survive a motion to dismiss, a complaint must contain sufficient factual matter, accepted as true, to 'state a claim to relief that is plausible on its face.'" *Ashcroft v. Iqbal*, 556 U.S. at 678 (2009) (quoting *Bell Atl. Corp. v. Twombly*, 550 U.S. 554, 558 (2007)). "Threadbare recitals of the elements of a cause of action, supported by mere conclusory statements, do not suffice." *Id*. Although a court must accept the factual allegations of a complaint as true, a court "need not accept legal conclusions couched as facts or 'unwarranted inferences, unreasonable conclusions, or arguments.'" *Wag More Dogs, LLC v. Cozart*, 680 F.3d 359, 365 (4th Cir. 2012) (quoting *Giarratano v. Johnson*, 521 F.3d 298, 302 (4th Cir. 2008)).

B. UDTPA Claim

To state a claim pursuant to the UDTPA, a plaintiff must allege (1) an unfair or deceptive act or practice; (2) in or affecting commerce; (3) which proximately caused actual injury to claimant. *Walker v. Fleetwood Homes of N.C., Inc*., 653 S.E.2d 393, 399 (N.C. 2007). A deceptive trade practice "is one that possesses the tendency or capacity to mislead, or creates the likelihood of deception." *Noble v. Hooters of Greenville (NC), LLC*, 681 S.E.2d 448, 452 (N.C. Ct. App. 2009). "A practice is unfair when it offends public policy and when the practice is immoral, unethical, oppressive, unscrupulous, or substantially injurious to consumers." *Walker v. Branch Banking & Tr. Co*., 515 S.E.2d 727, 729 (N.C. Ct. App. 1999) (internal citation omitted). Whether conduct is unfair or deceptive is a question of law for the court. *Gray v. N.C. Ins. Underwriting Ass'n*, 529 S.E.2d 676, 681 (N.C. 2000). To establish an UDTPA claim, Opticon must show "[s]ome type of *egregious or aggravating* circumstances." *Phelps Staffing, LLC v. C.T. Phelps, Inc*., 740 S.E.2d 923, 928 (N.C. Ct. App. 2013) (emphasis in original).

A "fundamental disagreement between the parties about a contract's terms" is not a "substantial aggravating circumstance" that could elevate a routine contract dispute to an unfair and deceptive act. *LRP Hotels of Carolina, LLC v. Westfield Ins. Co.*, No. 4:13-cv-94-D, 2014 WL 5581049, * 3 (E.D.N.C. Oct. 31, 2014); s*ee also Ditch Witch of Charlotte, Inc. v. Bandit Indus.*, No. 15-cv-181, 2017 WL 390290, at *4 (W.D.N.C. Jan. 27, 2017) ("The exercise of contractual rights is not an unfair trade practice under the North Carolina statute."). This is a contract dispute involving a disagreement as to the meaning of words in a settlement agreement. The Court rejects Opticon's attempt to transform it into a UDTPA claim.

C. Patent Misuse Claim

The doctrine of patent misuse bars a patentee from using the "patent's leverage" to "extend the monopoly of his patent to derive a benefit not attributable to the use of the patent's teachings." *Zenith Radio Corp. v. Hazeltine Res., Inc.*, 395 U.S. 100, 135-36 (1969). The key inquiry for patent misuse "is whether, by imposing conditions that derive their force from the patent, the patentee has impermissibly broadened the scope of the patent grant with anticompetitive effect." *C.R. Bard, Inc. v. M3 Sys., Inc*., 157 F.3d 1340, 1372 (Fed. Cir. 1998). Accordingly, to plead patent misuse a defendant must show that (1) a patentee has impermissibly broadened the scope of a patent grant; and (2) such broadening has an anticompetitive effect. *See id.*

Certain specific practices have been identified by the Federal Circuit as constituting "per se patent misuse," such as "tying arrangements." [1] *See U.S. Philips Corp. v. ITC*, 424 F.3d 1179, 1185 (Fed. Cir. 2005). Opticon does not make any allegations of per se patent misuse herein.

[1] "'[T]ying' arrangements [are a practice] in which a patentee conditions a license under the patent on the purchase of a separable, staple good, and arrangements in which a patentee effectively extends the term of its patent by requiring post-expiration royalties." *U.S. Philips Corp. v. Int'l Trade Comm'n*, 424 F.3d 1179, 1185 (Fed. Cir. 2005)

When an alleged practice is not per se patent misuse, the practice may still constitute patent misuse if it "has the effect of extending the patentee's statutory rights and does so with an anticompetitive effect." *Va. Panel Corp. v. MAC Panel Co*., 133 F.3d 860, 869 (Fed. Cir. 1997). In such circumstances, the rule of reason applies, wherein "the finder of fact must decide whether the questioned practice imposes an unreasonable restraint on competition, taking into account a variety of factors, including specific information about the relevant business, its condition before and after the restraint was imposed, and the restraint's history, nature, and effect." *Id*. Such a fact-specific analysis is inappropriate at this stage of the litigation and the Court will allow this issue, whether considered a counterclaim or affirmative defense, to go forward at this time.

D. Breach of Covenant of Good Faith and Fair Dealing

Opticon asserts, and Honeywell does not dispute, that Delaware law governs this claim.[2] The Court of Chancery of Delaware described the implied covenant of good faith and fair dealing as follows:

> The implied covenant of good faith and fair dealing inheres in every contract and "requires 'a party in a contractual relationship to refrain from arbitrary or unreasonable conduct which has the effect of preventing the other party to the contract from receiving the fruits' of the bargain." The implied covenant cannot be invoked to override the express terms of the contract. Moreover, rather than constituting a freefloating duty imposed on a contracting party, the implied covenant can only be used conservatively "to ensure the parties' 'reasonable expectations' are fulfilled." Thus, to state a claim for breach of the implied covenant, [plaintiff] "must allege a specific implied contractual obligation, a breach of that obligation by the defendant, and resulting damage to the plaintiff." General allegations of bad faith conduct are not sufficient. Rather, the plaintiff must allege a specific implied contractual obligation and allege how the violation of that obligation denied the plaintiff the fruits of the contract. Consistent with its narrow purpose, the implied covenant is only rarely invoked successfully.

[2] Honeywell argues that the claim fails under either Delaware or North Carolina law.

Kuroda v. SPJS Holdings, L.L.C., 971 A.2d 872, 888 (Del. Ch. 2009) (citations omitted). At this early stage of the litigation, the Court is reluctant to dismiss this claim, and finds that it has been plausibly alleged.

IT IS THEREFORE ORDERED that Plaintiffs' Motion to Dismiss Defendant's Counterclaims is hereby **GRANTED IN PART AND DENIED IN PART**. Plaintiff's Motion to Dismiss Defendant's Counterclaim for Unfair and Deceptive Trade Practices is hereby **GRANTED**, and the Motion to Dismiss Defendant's Patent Misuse and Breach of Duty of Good Faith and Fair Dealing claims is hereby **DENIED**.

Signed: April 14, 2022

Graham C. Mullen
United States District Judge

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION

HONEYWELL INTERNATIONAL INC., HAND HELD PRODUCTS, INC., and METROLOGIC INSTRUMENTS, INC., Plaintiffs, v. OPTO ELECTRONICS CO., LTD., Defendant	Case No. 3:21-cv-00506 JURY TRIAL DEMANDED

DEFENDANT'S OBJECTIONS AND RESPONSES TO PLAINTIFFS' FIRST SET OF REQUESTS FOR ADMISSION

Pursuant to Federal Rule of Civil Procedure 36, Defendant OPTO Electronics Co., Ltd. ("OPTO") provides these objections and responses to Plaintiffs Honeywell International Inc.'s; Hand Held Products, Inc.'s; and Metrologic Instruments, Inc.'s (collectively, "Honeywell's" or "Plaintiffs'") First Set of Requests for Admission ("Requests").

PRELIMINARY STATEMENT

OPTO has not yet completed its investigation of the facts relating to this action, its preparation for trial, or associated discovery. As discovery proceeds, OPTO may discover facts, information, evidence, documents and/or things that are not set forth herein, but which may be responsive to these Requests. These objections and responses are based on OPTO's present knowledge, information, and belief, and are complete to the best of OPTO's knowledge at this time.

Furthermore, OPTO has prepared these objections and responses based on its good-faith interpretation and understanding of the individual Requests. OPTO expressly reserves its right to correct any inadvertent errors or omissions. OPTO also reserves the right to conduct discovery with reference to or to offer evidence at the time of trial of any facts, evidence, documents, and things developed during discovery and trial preparation, notwithstanding the reference to certain facts, evidence, documents, and things in these objections and responses. Additionally, OPTO reserves the right to revise and supplement these objections and responses based on any information, evidence, and documentation that may be discovered after the service of these objections and responses, as appropriate. OPTO is not waiving, and expressly preserves, any and all objections to relevance, admissibility, or authenticity of any documents or information produced in conjunction herewith.

GENERAL OBJECTIONS

1. OPTO objects to the Requests to the extent that they seek to impose obligations beyond or inconsistent with those required by the Federal Rules of Civil Procedure, the Local Rules of the United States District Court for the Western District of North Carolina (the "Court"), any orders of the Court, or any stipulations or agreements of the parties.

2. OPTO objects to the Requests, including all definitions and instructions provided therein, to the extent that they would require OPTO to reach legal conclusions in order to respond.

3. OPTO objects to the Requests to the extent they call for information protected from disclosure by the attorney-client privilege, attorney work-product doctrine, or any other applicable privilege. Should any such disclosure by OPTO occur, it is inadvertent and shall not constitute a waiver of any privilege.

4. OPTO objects to the Requests to the extent that they seek trade secrets, research and development information, proprietary or confidential business or financial information, business plans or marketing information, or any other highly sensitive or confidential commercial information that is subject to protection under state or federal law or is otherwise within the protections of Rule 26(c) of the Federal Rules of Civil Procedure. To the extent that OPTO agrees to produce such information, or documents containing or reflecting such information, OPTO's production will be subject to the Protective Order entered in this Action.

5. OPTO objects to the Requests to the extent they require OPTO to marshal all of its evidence while discovery is ongoing.

6. OPTO objects to the definition of "Relevant Time Period" to the extent that the defined time period is overbroad as applied, and therefore unduly burdensome, and to the extent that it imposes obligations beyond or inconsistent with those required by the Federal Rules of Civil Procedure, the Local Rules of the Court, any orders of the Court, or any stipulations or agreement of the parties.

7. OPTO objects to the definition of "OPTO," "You," and "Your" as overbroad to the extent that it includes entities not involved in this action and not under the direction or control of OPTO.

RESPONSES AND SPECIFIC OBJECTIONS TO PLAINTIFFS'
FIRST SET OF REQUESTS FOR ADMISSION

ADMISSION REQUEST NO. 1

Admit that the Settlement Agreement is unambiguous.

RESPONSE:

OPTO specifically objects to this Request as premature as discovery is currently ongoing, and therefore OPTO has not formulated its final contentions regarding OPTO's claims and defenses in this case. OPTO accordingly reserves its right to supplement and/or amend its response as the record is developed through discovery. OPTO also objects to this Request to the extent it seeks information protected by the attorney-client privilege, work product protection, or any other privilege applicable by law. OPTO further objects to this Request as vague because the term "unambiguous" is undefined, unlimited in scope, and is subject to multiple, reasonable interpretations. Moreover, one portion of the Settlement Agreement may be "ambiguous," while a separate portion may be unambiguous. Thus, this Request is vague, and OPTO cannot admit or deny whether the Settlement Agreement is ambiguous without reference to a particular portion of the Agreement. Indeed, in addition to introductory statements and party identifications, the Settlement Agreement is a document that is 15 pages in length and includes 55 operative sections, many of which include multiple subparagraphs and multiple operative clauses and terms. Subject to and without waiving the foregoing General and specific objections, OPTO states as follows:

OPTO lacks sufficient knowledge or information concerning the specific terms, clauses, and provisions of the Settlement Agreement to which this Request requires an admission and therefore denies the Request.

To the extent that this Request requires OPTO's admissions regarding the term "Opticon Gross Revenue" as defined in Section 1.16, the term "Royalty-Bearing Product" as defined in

Section 1.14, and the term "Licensed Product" as defined in Section 1.8 of the Settlement Agreement, OPTO admits that those three terms are unambiguous.

ADMISSION REQUEST NO. 2

Admit that Section 1.4 of the Settlement Agreement is unambiguous.

RESPONSE:

OPTO specifically objects to this Request as premature as discovery is currently ongoing, and therefore OPTO has not formulated its final contentions regarding OPTO's claims and defenses in this case. OPTO accordingly reserves its right to supplement and/or amend its response as the record is developed through discovery. OPTO also objects to this Request to the extent it seeks information protected by the attorney-client privilege, work product protection, or any other privilege applicable by law. OPTO further objects to this Request as vague because the term "unambiguous" is undefined, unlimited in scope, and is subject to multiple, reasonable interpretations. Subject to and without waiving the foregoing General and specific objections, OPTO states as follows:

Admitted with the qualification that under the plain language of Section 1.4, 2D Barcode Products "shall include Engines and other products that include a 2D image sensor." Thus, the Settlement Agreement unambiguously defines "2D Barcode Products" as those that contain an image sensor.

OPTO's laser scanning barcode products do not contain an image sensor and, by extension, do not use an image sensor to decode symbologies. Thus, the Settlement Agreement is unambiguous that OPTO's laser scanning barcode products that can decode multi-row, stacked symbols, such as PDF417, MicroPDF417, and/or GS1 stacked codes, are not "2D Barcode Products" under the Settlement Agreement.

To the extent the above is found by the Court not to resolve the issue, then OPTO denies this Request as Section 1.4 of the Settlement Agreement then would be ambiguous at least as to the definition of "2D Barcode Products," and whether OPTO's laser scanning products listed in Honeywell's Complaint that can decode multi-row, stacked symbols, such as PDF417, MicroPDF417, and/or GS1 stacked codes, would fall under that definition.

ADMISSION REQUEST NO. 3

Admit that PDF417 is a two-dimensional barcode symbology.

RESPONSE:

OPTO specifically objects to this Request as premature as discovery is currently ongoing, and therefore OPTO has not formulated its final contentions regarding OPTO's claims and defenses in this case. OPTO accordingly reserves its right to supplement and/or amend its response as the record is developed through discovery. OPTO also objects to this Request to the extent it seeks information protected by the attorney-client privilege, work product protection, or any other privilege applicable by law. OPTO further objects to this Request as vague because the term "two-dimensional barcode symbology" is an undefined term that is subject to multiple reasonable interpretations. OPTO interprets this Request to seek OPTO's position concerning whether PDF417 is a "two-dimensional barcode symbology" under the Settlement Agreement, such that a product that is capable of decoding the encoded symbology of PDF417 is a "2D Barcode Product" as that term is defined in Section 1.4 of the Settlement Agreement. Subject to and without waiving the foregoing General and specific objections, OPTO states as follows:

Denied.

ADMISSION REQUEST NO. 4

Admit that PDF417 is a "continuous, multi-row two-dimensional" code type as defined in ISO/IEC 15438:2006.

RESPONSE:

OPTO specifically objects to this Request as premature as discovery is currently ongoing, and therefore OPTO has not formulated its final contentions regarding OPTO's claims and defenses in this case. OPTO accordingly reserves its right to supplement and/or amend its response as the record is developed through discovery. OPTO also objects to this Request to the extent it seeks information protected by the attorney-client privilege, work product protection, or any other privilege applicable by law. Subject to and without waiving the foregoing General and specific objections, OPTO states as follows:

Admitted that PDF417 is a continuous, multi-row two-dimensional code type symbol that is constructed graphically as a series of rows of symbol characters, representing data and overhead components, placed in a defined vertical arrangement to form a (normally) rectangular symbol, which contains a single data message so that each symbol character has the characteristics of a linear bar code symbol character, and each row has those of a linear bar code symbol as defined in ISO/IEC 15438:2006 and ISO/IEC 15415:2011.

ADMISSION REQUEST NO. 5

Admit that MicroPDF417 is a two-dimensional barcode symbology.

RESPONSE:

OPTO specifically objects to this Request as premature as discovery is currently ongoing, and therefore OPTO has not formulated its final contentions regarding OPTO's claims and defenses in this case. OPTO accordingly reserves its right to supplement and/or amend its response

as the record is developed through discovery. OPTO also objects to this Request to the extent it seeks information protected by the attorney-client privilege, work product protection, or any other privilege applicable by law. OPTO further objects to this Request as vague because the term "two-dimensional barcode symbology" is an undefined term that is subject to multiple reasonable interpretations. OPTO interprets this Request to seek OPTO's position concerning whether MicroPDF417 is a "two-dimensional barcode symbology" under the Settlement Agreement, such that a product that is capable of decoding the encoded symbology of MicroPDF417 is a "2D Barcode Product" as that term is defined in Section 1.4 of the Settlement Agreement. Subject to and without waiving the foregoing General and specific objections, OPTO states as follows:

Denied.

ADMISSION REQUEST NO. 6

Admit that GS1 stacked code is a two-dimensional barcode symbology.

RESPONSE:

OPTO specifically objects to this Request as premature as discovery is currently ongoing, and therefore OPTO has not formulated its final contentions regarding OPTO's claims and defenses in this case. OPTO accordingly reserves its right to supplement and/or amend its response as the record is developed through discovery. OPTO also objects to this Request to the extent it seeks information protected by the attorney-client privilege, work product protection, or any other privilege applicable by law. OPTO further objects to this Request as vague because the term "two-dimensional barcode symbology" is an undefined term that is subject to multiple reasonable interpretations. OPTO interprets this Request to seek OPTO's position concerning whether GS1 stacked code is a "two-dimensional barcode symbology" under the Settlement Agreement, such that a product that is capable of decoding the encoded symbology of GS1 stacked code is a "2D

Barcode Product" as that term is defined in Section 1.4 of the Settlement Agreement. Subject to and without waiving the foregoing General and specific objections, OPTO states as follows:

Denied.

ADMISSION REQUEST NO. 7

Admit that composite code is a two-dimensional barcode symbology.

RESPONSE:

OPTO specifically objects to this Request as premature as discovery is currently ongoing, and therefore OPTO has not formulated its final contentions regarding OPTO's claims and defenses in this case. OPTO accordingly reserves its right to supplement and/or amend its response as the record is developed through discovery. OPTO also objects to this Request to the extent it seeks information protected by the attorney-client privilege, work product protection, or any other privilege applicable by law. OPTO further objects to this Request as vague because the term "two-dimensional barcode symbology" is an undefined term that is subject to multiple reasonable interpretations. OPTO interprets this Request to seek OPTO's position concerning whether composite code is a "two-dimensional barcode symbology" under the Settlement Agreement, such that a product that is capable of decoding the encoded symbology of composite code is a "2D Barcode Product" as that term is defined in Section 1.4 of the Settlement Agreement. Subject to and without waiving the foregoing General and specific objections, OPTO states as follows:

Denied.

ADMISSION REQUEST NO. 8

Admit that U.S. Patent No. 7,159,783 is licensed under the Settlement Agreement.

RESPONSE:

OPTO specifically objects to this Request as premature as discovery is currently ongoing, and therefore OPTO has not formulated its final contentions regarding OPTO's claims and defenses in this case. OPTO accordingly reserves its right to supplement and/or amend its response as the record is developed through discovery. OPTO also objects to this Request to the extent it seeks information protected by the attorney-client privilege, work product protection, or any other privilege applicable by law. OPTO also objects to the extent this Request prematurely seeks disclosure of information that is within the scope of expert testimony or opinion, which will be provided in accordance with the schedule entered by the Court. Subject to and without waiving the foregoing General and specific objections, OPTO states as follows:

Denied, as OPTO explained in its response to Honeywell Interrogatory No. 6.

ADMISSION REQUEST NO. 9

Admit that Honeywell accused each of the following products of infringing U.S. Patent No. 7,159,783 in the ITC Investigation: OPN-2001, OPN-2004, OPN-2006, OPN-4000i, OPN-4000n, NFT-2200, NFT-2100, NFT-8175, NLB-1000, NLV-1001, NLV-4001, RLB-1000, C-37, C-41S, L-46R, L-50C, OPC-3301i, OPI-3301i, OPL-6845S, OPR-2001Z, OPR-2001, OPR- 3201Z, RS-2006/OPN2006, MDC-200, MDL-1000, MDL-1500, MDL-2001, OPR-3004, OPR- 3101, F-100, F-70, C-40, C-41, MDL-2101.

RESPONSE:

OPTO specifically objects to this Request as premature as discovery is currently ongoing, and therefore OPTO has not formulated its final contentions regarding OPTO's claims and defenses in this case. OPTO accordingly reserves its right to supplement and/or amend its response as the record is developed through discovery. OPTO also objects to this Request to the extent it

seeks information protected by the attorney-client privilege, work product protection, or any other privilege applicable by law. OPTO also objects to the extent this Request prematurely seeks disclosure of information that is within the scope of expert testimony or opinion, which will be provided in accordance with the schedule entered by the Court. Subject to and without waiving the foregoing General and specific objections, OPTO states as follows:

Admitted that the products listed in this request were accused of infringing the ’783 patent from May 31, 2019, when Honeywell filed its Complaint in the ITC Investigation, until November 15, 2019, when Honeywell voluntarily and unconditionally dropped all accusations of infringement against the listed products.

ADMISSION REQUEST NO. 10

Admit that each of the following products had the capability to read or decode at least one of composite codes, PDF417, MicroPDF417, or GS1 stacked symbologies during at least some point in time during the Relevant Time Period: OPN-2001, OPN-2004, OPN-2006, OPN- 4000i, OPN-4000n, NFT-2200, NFT-2100, NFT-8175, NLB-1000, NLV-1001, NLV-4001, RLB- 1000, C-37, C-41S, L-46R, L-50C, OPC-3301i, OPI-3301i, OPL-6845S, OPR-2001Z, OPR-2001, OPR-3201Z, RS-2006/OPN2006, MDC-200, MDL-1000, MDL-1500, MDL-2001, OPR-3004, OPR-3101, F-100, F-70, C-40, C-41, MDL-2101.

RESPONSE:

OPTO specifically objects to this Request as premature as discovery is currently ongoing, and therefore OPTO has not formulated its final contentions regarding OPTO’s claims and defenses in this case. OPTO accordingly reserves its right to supplement and/or amend its response as the record is developed through discovery. OPTO also objects to this Request to the extent it seeks information protected by the attorney-client privilege, work product protection, or any other

privilege applicable by law. OPTO also objects to the extent this Request prematurely seeks disclosure of information that is within the scope of expert testimony or opinion, which will be provided in accordance with the schedule entered by the Court. Subject to and without waiving the foregoing General and specific objections, OPTO states as follows:

Denied as to NFT-2200 and NFT-2100. Denied as to OPR-3101, as there were no sales of that product during the Relevant Time Period. Admitted that each of the remaining products listed in this request had the capability to read or decode at least one of composite code, PDF417, MicroPDF417 or GS1 stacked code at some point during the Relevant Time Period.

Dated: August 29, 2022

MCGUIREWOODS LLP

/s/ Robert A. Muckenfuss

Robert A. Muckenfuss
North Carolina Bar No. 28218
Zachary L. McCamey
North Carolina Bar No. 53540
201 North Tryon Street, Suite 3000
Charlotte, NC 28202-2146
Telephone: (704) 343-2244
Facsimile: (704) 353-6160
rmuckenfuss@mcguirewoods.com
zmccamey@mcguirewoods.com

Attorneys for Defendant OPTO Electronics Co., Ltd.

CERTIFICATE OF SERVICE

I certify that on August 29, 2022, a copy of the foregoing was served via email on the counsel of record, as follows:

ALSTON & BIRD LLP
101 S. Tryon Street, Suite 4000
Charlotte, NC 28280

S. Benjamin Pleune
ben.pleune@alston.com

M. Scott Stevens
scott.stevens@alston.com

Mark T. Calloway
mark.calloway@alston.com

Michael R. Hoernlein
michael.hoernlein@alston.com

Stephen R. Lareau
Stephen.Lareau@alston.com

Brandon Springer
brandon.springer@alston.com

Lauren N. Griffin
lauren.griffin@alston.com

*/s/ Robert A. Muckenfuss*_________
Robert A. Muckenfuss

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION
CASE NO. 3:21-CV-506-KDB-DCK

HONEYWELL INTERNATIONAL INC., METROLOGIC INSTRUMENTS, INC., and HAND HELD PRODUCTS, INC.,	)	
Plaintiffs,	)	**ORDER**
v.	)	
OPTO ELECTRONICS CO., LTD.,	)	
Defendants.	)	

THIS MATTER IS BEFORE THE COURT regarding multiple discovery disputes. See (Document No. 114). These disputes were referred to the undersigned Magistrate Judge by the Honorable Graham C. Mullen on November 7, 2022, and are ripe for disposition. Having carefully considered the record, the parties' "Amended Joint Status Report" (Document No. 114), and the arguments of counsel at a hearing on February 15, 2023, the undersigned will grant in part and deny in part the parties' discovery requests as set forth below.

The undersigned commends counsel for the "Amended Joint Status Report" and their strong oral advocacy that greatly assisted the undersigned's consideration of the pending disputes. Counsel are respectfully encouraged to work together in good faith to complete discovery in this matter efficiently, and without further Court intervention.

IT IS, THEREFORE, ORDERED that the discovery disputes as identified in the "Amended Joint Status Report" (Document No. 114) are granted in part and denied in part as follows.

Issue 1: Honeywell Seeks OPTO's Non-Privileged Analysis of Honeywell's Patents.

This request is granted. OPTO shall produce the documents collected by Mr. Kohmo as identified during the hearing and in Honeywell's "Brief In Support Of Motion To Compel Discovery" (Document No. 51-1, p. 11).

Issue 2: Honeywell Seeks Production of OPTO's Post-2020 Analysis of Honeywell's Patents.

This request is denied.

Issue 3: Honeywell Seeks the Production of Area-Imager-Based Source Code.

This request is granted.

Issue 4: Honeywell Seeks the Deposition of Masaki Kurokawa.

This request is granted. The deposition of Mr. Kurokawa shall be held in Charlotte, North Carolina, unless otherwise agreed by the parties.

Issue 5: Honeywell Seeks Documents Identified at Kees Stoop's Deposition.

This request is denied.

Issue 6: Honeywell seeks Documentation and Correspondence Regarding OPTO's Independent Auditor's Statements About this Litigation.

This request is granted.

Issue 7: Honeywell Seeks Counsel-Prepared Documents About the Settlement Agreement.

This request is denied.

Issue 8: Honeywell Seeks the Continued Deposition of Mr. Tanaka and Mr. Kohmo.

This request is granted in part and denied in part. Mr. Kohmo shall not be compelled to testify. The deposition of Mr. Tanaka shall be held in Charlotte, North Carolina, unless otherwise agreed by the parties.

Issue 9: Honeywell Seeks the Deposition of Nick Kamio.

This request is granted. The deposition of Mr. Kamio shall be held in Charlotte, North Carolina, unless otherwise agreed by the parties.

Issue 10: Honeywell Seeks OPTO's Technical Documents.

This request is granted. The undersigned expects this production to be narrowed as suggested by counsel at the hearing to what may be a relatively simple chart. Counsel are directed to work together to reach a final agreement on a responsive document(s).

Issue 11: OPTO Seeks Honeywell's Sales Information.

This request is granted. Honeywell shall provide responsive information related to the transactional sales information for Honeywell's "Voyager" products, and "summary sales information" related to Honeywell's sales of laser and image-sensor based barcode scanning products sufficient to establish the quantities and price points at which those products are sold. Counsel are respectfully encouraged to work together to agree on the production of summary sales information that is reasonably narrowed.

Issue 12: OPTO Seeks Guidance as to Extension of Expert Deadlines.

This request is granted. OPTO shall submit its expert report related to the economic prong of OPTO's patent misuse counterclaim within four (4) weeks of Honeywell's production of sales information.

Counsel for the parties shall confer and submit a joint proposal regarding revised case deadlines, including expert reports and the completion of discovery as ordered herein, on or before **March 3, 2023**.

Issue 13: OPTO Seeks Attorney Communications and Attorney Work Product Related to Honeywell's Audit of OPTO's Worldwide Sales.

This request is denied. Honeywell is not required to produce the internal communications between counsel, and/or between counsel and Honeywell, regarding the independent audit.

Issue 14: OPTO Seeks Deposition of Benjamin Pleune.

This request is denied. See Bell v. Kaplan, 2017 WL 9802760 (W.D.N.C. Sept. 8, 2017) (citing Shelton v. Am. Motors Corp., 805 F.2d 1323 (8th Cir. 1986)).

Issue 15: OPTO Seeks Deposition of Scott Stevens.

This request is denied.

Issue 16: OPTO Seeks Reimbursement of Expenses and Protective Order Related to Deposition of Masaki Kurokawa.

This request is denied.

SO ORDERED.

Signed: February 16, 2023

David C. Keesler
United States Magistrate Judge

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION

HONEYWELL INTERNATIONAL INC., HAND HELD PRODUCTS, INC., and METROLOGIC INSTRUMENTS, INC.,

Plaintiffs,

v.

OPTO ELECTRONICS CO., LTD.,

Defendant and Counterclaim Plaintiff,

v.

HONEYWELL INTERNATIONAL INC., HAND HELD PRODUCTS, INC., and METROLOGIC INSTRUMENTS, INC.,

Counterclaim Defendants.

HONEYWELL'S MOTION FOR PARTIAL SUMMARY JUDGMENT AND LEGAL DETERMINATIONS REGARDING CONTRACTUAL INTERPRETATION

Case No. 3:21-cv-00506

Plaintiffs Honeywell International Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. ("Honeywell") move the Court under Federal Rule of Civil Procedure 56 for the following relief:

1. An order granting partial summary judgment that Section 1.4 of the License and Settlement Agreement unambiguously defines "2D Barcode Products" to include "any device or article of manufacture that is operable to decode at least one or more two-dimensional barcode symbologies into human-readable text."

2. An order granting partial summary judgement that the License and Settlement Agreement does not require an independent audit as a condition precedent for filing a breach-of-contract action.

The grounds for this Motion for Partial Summary Judgment are more fully set forth in Honeywell's accompanying Memorandum in Support. Honeywell respectfully requests a hearing on the present motion at the Court's convenience.

Submitted February 22, 2023

/s/ *S. Benjamin Pleune*
S. Benjamin Pleune (NC Bar No. 28748)
M. Scott Stevens (NC Bar No. 37828)
Mark T. Calloway (NC Bar No. 10822)
Michael R. Hoernlein (NC Bar No. 40419)
Stephen R. Lareau (NC Bar No. 42992)
Brandon Springer (NC Bar No. 54523)
Lauren N. Griffin (NC Bar No. 54766)
ALSTON & BIRD LLP
101 S. Tryon Street, Suite 4000
Charlotte, NC 28280
Telephone: (704) 444-1000
Facsimile: (704) 444-1935

Counsel for Plaintiffs and Counterclaim Defendants
Honeywell International Inc.,
Hand Held Products, Inc., and
Metrologic Instruments, Inc.

CERTIFICATE OF SERVICE

I certify that on February 22, 2023 I filed a copy of this Motion for Partial Summary Judgment using the Court's CM/ECF system, which automatically provides service to all counsel of record.

/s/ *S. Benjamin Pleune*
S. Benjamin Pleune
N.C. Bar No. 28748
ALSTON & BIRD LLP
Bank of America Plaza, Suite 4000
101 South Tryon Street
Charlotte, NC 28280
Tel: (704) 444-1000
Fax: (704) 444-1111
ben.pleune@alston.com

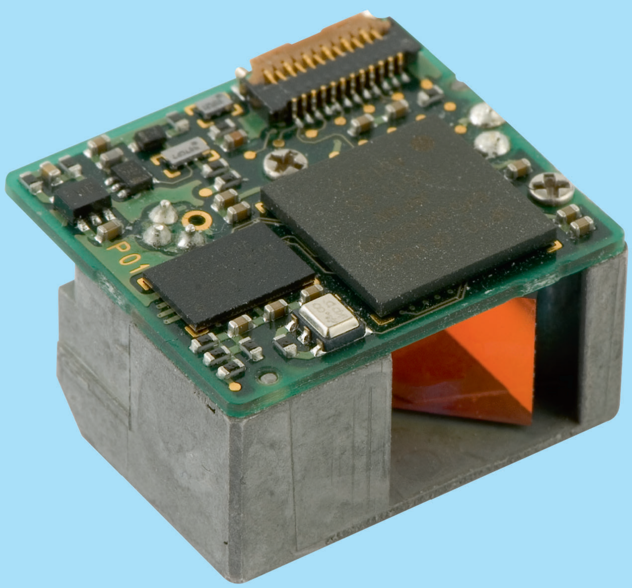
Counsel for Plaintiffs and Counterclaim Defendants
Honeywell International Inc.,
Hand Held Products, Inc., and
Metrologic Instruments, Inc.

EXHIBIT C

OEM

MDL-2001

Laser Barcode Scan Engine



Highlights

- Features a 650 nm visible laser diode that scans bi-directionally
- Extremely fast scan rate of 100 scans/second
- Small size makes it easy to mount and integrate into space constrained areas
- Connects via 12 pin FFC connector
- Programmable software with a wide variety of options
- Low profile, square scan engine—dimensions of 0.80" x 0.44" x 0.71" and weight of 0.17 ounces
- Engineering kit available – enables faster time to market
- Two year warranty

OPTICON

MDL-2001

Product Specifications

COMMUNICATION

SERIAL CMOS: 12 pin FFC connector

POWER

VOLTAGE REQUIREMENT: 3.3V ± 10%

CURRENT CONSUMPTION: Maximum 125mA

BARCODE SCANNER OPTICS

LIGHT SOURCE: 650 nm visible laser diode

SCAN METHOD: Bi-directional

SCANNING SCAN RATE: 100 scans/sec

READING PITCH ANGLE: -35 to 0°, 0 to +35°

READING SKEW ANGLE: -50 to -8°, +8 to +50°

READING TILT ANGLE: -20 to 0°, 0 to +20°

CURVATURE: R>15 mm (EAN 8), R>20 mm (EAN 13)

MINIMUM RESOLUTION AT PCS 0.9: 5 mil (0.127 mm)

MINIMUM PCS VALUE: 0.45

DEPTH OF FIELD AT PCS 0.9 CODE 39:
39 mil (1.0 mm) 2.76 - 25.59 in (70 - 650 mm)
20 mil (0.5 mm) 1.97 - 16.54 in (50 - 420 mm)
10 mil (0.25 mm) 1.97 - 10.24 in (50 - 260 mm)
6 mil (0.15 mm) 1.97 - 5.91 in (50 - 150 mm)
5 mil (0.127 mm) 2.36 - 4.72 in (60- 120 mm)

SUPPORTED SYMBOLOGIES

BARCODE (1D): JAN/UPC/EAN incl. add on, Codabar/NW-7, Code 11, Code 39, Code 93, Code 128, GS1-128 (EAN -128), GS1 DataBar (RSS), IATA , Industrial 2of5, Interleaved 2of5, ISBN-ISMN-ISSN, Matrix 2of5, MSI/Plessey, S-Code, Telepen, Tri-Optic, UK/Plessey

BARCODE (2D): Composite codes, MicroPDF417, PDF417

BARCODE (POSTAL CODES): Chinese Post, Korean Postal Authority code

DURABILITY

TEMPERATURE:
Operation: -4 to 149 °F (-20 to 65 °C)
Storage: -22 to 158 °F (-30 to 70 °C)

HUMIDITY:
Operation: 5 - 90% (non-condensing)
Storage: 5 - 90% (non-condensing

AMBIENT LIGHT IMMUNITY:
Fluorescent: 4,000 lx max
Direct sun: 80,000 lx max
Incandescent: 4,000 lx max

DROP TEST: packed in dummy case 6 ft (1.8 m) drop onto concrete surface

MBTF: 30,000 hours except laser diode (10.000 hours) and except mirror scan unit (10,000 hours)

PHYSICAL

DIMENSIONS (WXHXD): 0.80 x 0.44 x 0.71 in (20.4 x 11.2 x 18.0 mm)

WEIGHT BODY: Ca. 0.17 oz (4.7 g)

REGULATORY AND SAFETY

PRODUCT COMPLIANCE: RoHS, JIS-C-6802 Class 2, FDA CDRH Class II

SOLD SEPARATELY

MEK1000 SDK: Development board, Getting started disc, RS232 cable

CONNECTION CABLE, POWER SUPPLY:
100-240V/0.5A, 50/60 Hz, 5V/2A

WWW.OPTICONUSA.COM

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA

HONEYWELL INTERNATIONAL INC., HAND HELD PRODUCTS, INC., and METROLOGIC INSTRUMENTS, INC., Plaintiffs, v. OPTO ELECTRONICS CO., LTD., Defendant.	Case No. 3:21-cv-00506 JURY TRIAL DEMANDED

DEFENDANT OPTO ELECTRONICS CO., LTD'S
MOTION FOR SUMMARY JUDGMENT

Defendant OPTO Electronics Co., Ltd. ("OPTO"), by and through its undersigned counsel and pursuant to Federal Rule of Civil Procedure 56 and Local Rule 7.1, hereby respectfully moves this Court to enter summary judgment in favor of OPTO and against Plaintiffs Honeywell International Inc.; Hand Held Products, Inc.; and Metrologic Instruments, Inc. (collectively, "Honeywell") on Honeywell's breach of contract claim against OPTO. The grounds and authorities in support of this Motion are set forth in OPTO's Memorandum of Law in Support of its Motion for Summary Judgment and the exhibits thereto, filed contemporaneously herewith.

WHEREFORE, OPTO respectfully requests that this Court enter an order granting OPTO's Motion for Summary Judgment in its entirety.

Dated: March 8, 2023

Respectfully submitted,

McGuireWoods LLP

/s/ Robert A. Muckenfuss
Robert Muckenfuss, NC State Bar #28218
Zachary L. McCamey, NC State Bar #53540
Jessica O'Brien, NC State Bar #56679
McGuireWoods LLP
201 N. Tryon Street, Suite 3000
Charlotte, North Carolina 28202
Telephone: 704 343 2351 Facsimile: 704 444 8869
rmuckenfuss@mcguirewoods.com
zmccamey@mcguirewoods.com
jobrien@mcguirewoods.com

Tyler T. VanHoutan
McGuireWoods LLP
Texas Tower, Ste 2400
845 Texas Avenue
Houston, TX 77002
Telephone: 832-214-9911
tvanhoutan@mcguirewoods.com

Christine E. Lehman
Connor S. Houghton
Reichman Jorgensen Lehman & Feldberg LLP
1909 K St, NW, Suite 800
Washington, DC 20006
Telephone: 650-623-1401
clehman@reichmanjorgensen.com
choughton@reichmanjorgensen.com

York M. Faulkner
YorkMoodyFaulkner
Tensho Bldg., 7F, Suite 711
3-17-11 Shibaura, Minato-ku
Tokyo, Japan 108-0023
Telephone: +1-202-251-0837
york.faulkner@ymf-law.com

Attorneys for Defendant Opto Electronics Co., LTD.

CERTIFICATE OF SERVICE

I hereby certify that on March 8, 2023, a copy of the foregoing was filed electronically with the Clerk of the Court for the Western District of North Carolina by using the CM/ECF system. Counsel for all parties in this case are registered CM/ECF users and will be served by the CM/ECF system.

/s/ Robert A. Muckenfuss
Robert A. Muckenfuss

Exhibit 1

DOCKET NUMBER
3392
Office of the Secretary
Int'l Trade Commission

ALSTON&BIRD LLP

The Atlantic Building
950 F Street, NW
Washington, DC 20004-1404

202-239-3300
Fax: 202-654-4842
www.alston.com

M. Scott Stevens
Direct Dial: 202-239-3025
Email: scott.stevens@alston.com

May 31, 2019

VIA HAND DELIVERY

The Honorable Lisa R. Barton
Secretary
U.S. International Trade Commission
500 E Street, S.W., Room 112
Washington, DC 20436

Re: *Certain Barcode Scanners, Scan Engines, Products Containing the Same, and Components Thereof, Docket No. 337-TA-____*

Dear Secretary Barton:

Enclosed for filing please find documents in support of a request by Complainants Honeywell International, Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. (collectively "Honeywell") that the U.S. International Trade Commission institute an investigation pursuant to Section 337 of the Tariff Act of 1930, as amended, concerning certain barcode scanners, scan engines, products containing the same, and components thereof. A separate letter requesting confidential treatment of Confidential Exhibits 37 and 38 is included with this filing. There is no confidential business information contained in the Complaint itself. Honeywell's submission includes the following documents:

- One (1) original and eight (8) true paper copies of the Complaint, pursuant to Commission Rule 210.8(a)(1)(i).
- One (1) electronic copy of the non-confidential exhibits to the Complaint, pursuant to Commission Rules 210.8(a)(1)(i) and 210.12(a)(9), including:
  - One (1) electronic certified copy each of U.S. Pat. Nos. 9,465,970; 8,978,985; 7,148,923; 7,527,206; 9,659,199; 7,159,783; and 8,794,520 as Exhibits 1-7 to the Verified Complaint, respectively, pursuant to Commission Rule 210.12(a)(9)(i); and
  - One (1) electronic certified copy of the assignment records for each of the 970, 985, 923, 206, 783, and 520 patents as Exhibits 8-11 and 13-14 to the Verified Complaint, respectively, pursuant to Commission Rule

210.12(a)(9)(ii). Also enclosed is a non-certified copy of the assignment record for the 199 patent. We have placed an order with the U.S. Patent & Trademark Office for the certified copy of this assignment record, and will submit it when it arrives.

- One (1) electronic copy of the confidential exhibits to the Verified Complaint, pursuant to Commission Rule and 210.8(a)(1)(ii).

- One (1) additional copy each — four (4) additional copies total — of the Complaint and accompanying electronic copies of the non-confidential exhibits, for service upon each Proposed Respondent, pursuant to Commission Rule 210.8(a)(1)(iii); and four (4) additional copies of the confidential exhibits for service upon Proposed Respondents' counsel after they have subscribed to the Protective Order.

- One (1) additional copy each – two (2) additional copies total – of the Complaint for the governments of Japan and the Netherlands, pursuant to Commission Rule 210.8(a)(1)(iv).

- One (1) physical sample of a domestic article protected by the asserted patents, as Exhibit P1 to the Complaint, pursuant to Commission Rule 210.12(b).

- One (1) physical sample of an imported article that is the subject of the Complaint, as Exhibit P2 to the Complaint, pursuant to Commission Rule 210.12(b).

- Certified copies of the prosecution histories of the 923 and 206 Patents as Appendices C-D to the Complaint. Also enclosed are non-certified copies of the prosecution histories of the 970, 985, 199, 783, and 520 patents as Appendices A-B and E-G to the Complaint. We have placed an order with the U.S. Patent & Trademark Office for the certified copies of these prosecution histories, and will submit them when they arrive.

- Three (3) additional electronic copies each of the prosecution histories of the 970, 985, 923, 206, 199, 783, and 520 Patents as Appendices A-G to the Complaint, pursuant to Commission Rule 210.12(c)(1).

- Four (4) electronic copies each of each patent and applicable pages of each technical reference mentioned in the prosecution histories of the 970, 985, 923, 206, 199, 783, and 520 Patents as Appendices H-N to the Complaint, pursuant to Commission Rule 210.12(c)(2).

- A letter and certification requesting confidential treatment for the information contained in Confidential Exhibits 37 and 38 to the Complaint, pursuant to Commission Rules 201.6(b) and 210.5(d).

- A Statement on the Public Interest regarding the remedial orders sought by Honeywell in the Complaint, pursuant to Commission Rule 210.8(b).

Thank you for your attention to this matter. Please contact me with any questions pertaining to this submission.

Sincerely,

M. Scott Stevens

Counsel for Complainants

Enclosures

ALSTON&BIRD LLP
The Atlantic Building
950 F Street, NW
Washington, DC 20004-1404

202-239-3300
Fax: 202-654-4842
www.alston.com

M. Scott Stevens Direct Dial: 202-239-3025 Email: scott.stevens@alston.com

May 31, 2019

VIA HAND DELIVERY

Office of the Secretary
Lisa R. Barton
Secretary to the Commission
U.S. International Trade Commission
500 E. Street, S.W., Room 317
Washington, DC 20436

Re: *Certain Barcode Scanners, Scan Engines, Products Containing the Same, and Components Thereof, Docket No. 337-TA-____*

REQUEST FOR CONFIDENTIAL TREATMENT

Dear Secretary Barton:

Pursuant to Commission Rule 201.6, Complainants Honeywell International, Inc., Hand Held Products, Inc., Metrologic Instruments, Inc. (collectively "Honeywell") hereby respectfully request confidential treatment of certain confidential business information contained in Confidential Exhibits 37 and 38 to Honeywell's Complaint, filed herewith.

The information for which confidential treatment is sought consists of proprietary commercial secrets, specifically:

- Proprietary information regarding Honeywell's licensees and others who may have rights to the one or more of the Asserted Patents (Confidential Exhibit 37).

- Proprietary financial data in Honeywell's investments in the facilities, engineering, and research and development of those products protected by one or more claims of the Asserted Patents (Confidential Exhibits 38).

The business information described herein qualifies as confidential business information because substantially-identical information is not available to the public and its disclosure would likely impair the Commission's ability to obtain information necessary to perform its statutory functions as well as cause substantial harm to the competitive position of the organizations from which the information is not available to the public is attached hereto.

May 31, 2019
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Thank you for your attention to this matter. Please contact me with any questions pertaining to this submission.

Sincerely,

M. Scott Stevens

Enclosures (certification)

CERTIFICATION

I, M Scott Stevens, attorney for Honeywell International, Inc., Hand Held Products, Inc. d/b/a Honeywell Scanning & Mobility, Metrologic Instruments, Inc. (collectively "Honeywell"), declare:

1. I am duly authorized by Honeywell to execute this certification.

2. I have reviewed Confidential Exhibits 23, 25-28, 31 and 32 to Honeywell's Complaint, for which confidential treatment has been requested.

3. To the best of my knowledge, information and belief, founded after reasonable inquiry, substantially-identical information is not available to the public

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 23rd day of May, 2017, in Charlotte, NC.

M. Scott Stevens

U.S. INTERNATIONAL TRADE COMMISSION
WASHINGTON, DC

In the Matter of **CERTAIN BARCODE SCANNERS, SCAN ENGINES, PRODUCTS CONTAINING THE SAME, AND COMPONENTS THEREOF**	**Investigation No. 337-TA-___**

COMPLAINANTS' PUBLIC INTEREST STATEMENT

Complainants Honeywell International, Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. (collectively "Honeywell") submit this public-interest statement, as required by 19 C.F.R. § 210.8(b). As discussed below, the remedy sought against Opticon, Inc., Opticon Sensors Europe B.V., OPTO Electronics Co., Ltd., and Hokkaido Electronic Industry Co., Ltd. (collectively "Respondents" or "Opticon") will not have an adverse effect on public health or welfare, competitive conditions in the U.S. economy, production of like or directly competitive articles in the United States, or U.S. consumers.

I. THE REQUESTED REMEDY WILL NOT HARM THE PUBLIC INTEREST

The Accused Products in this matter, as defined in the accompanying complaint, are Respondents' barcode scanners, scan engines, and related products that infringe the Asserted Patents. As a result, the requested remedy is directed only at those specific products manufactured by or on behalf of Respondents and sold for importation, imported, and/or sold after importation into the United States. Thus, the only potentially relevant public-interest inquiry is whether the exclusion of this discrete subset of articles, not barcode readers generally, necessitates the denial of Section 337 relief based on the statutory public-interest factors. As shown below, there are no public interest concerns implicated by this small subset of devices that would implicate public interest for at least three reasons.

First, the exclusion order would not exclude devices that specifically implicate the significant national security or public health issues upon which the ITC has precluded or reduced relief in the past.[1] Second, Respondents' Accused Products generally make up a small minority of the U.S. market for barcode scanners. Third, any demand gap felt by the exclusion order could be made up by Honeywell and/or Honeywell's competitors. Honeywell expands on these reasons below.

II. SPECIFIC PUBLIC-INTEREST INQUIRIES

A. The Commission has a Strong Public Interest in Protecting IP

The ITC has made clear that the public interest rests in the protection of intellectual-property rights ("IPR").[2] That protection is to be denied in only limited situations.[3] The question with respect to the public interest, then, is not whether a "balancing" of factors merely favors a remedy, but rather whether competing interests exist of so great a significance with regard to only the Accused Products that the strong public policy of protecting IPR must give way. As shown below, any public interest concerns invoked by this investigation pales in comparison to this countervailing interest.

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[1] *See Certain Fluidized Supporting Apparatus*, Inv. Nos. 337-TA-182/188, Comm'n Op. (Oct. 5, 1984); *Certain Inclined-Field Acceleration Tubes,* Inv. No. 337-TA-67, Comm'n. Op. (Dec. 29, 1980); *Certain Automatic Crankpin Grinders,* Inv. No. 337-TA-60, Comm'n Op. (Dec. 17, 1979); *see also Personal Data & Mobile Communication Devices,* Inv. No. 337-TA-710, Comm'n Op., at 81 n.56 (Dec. 29, 2011) (stating that the ITC "does not believe that the mere fact that a technological field has been determined to provide benefits to the economy is sufficient to excuse infringement of a patent in that field").

[2] *See, e.g., Certain Digital Television Prods. & Certain Prods. Containing Same & Methods of Using Same*, Inv. No. 337-TA-617, Comm'n Op., at 9 (Aug. 23, 2009) ("*Digital TV Products*").

[3] *See Certain Baseband Processor Chips & Chipsets, Transmitter & Receiver (Radio) Chips, Power Control Chips, & Prods. Containing Same, Including Cellular Tel. Handsets,* Inv. No. 337-TA-543, Comm'n Op., at 153 (June 19, 2007) ("[T]he statute requires relief for an aggrieved patent holder, except in those limited circumstances in which the statutory public interest concerns are so great as to trump the public interest in enforcement of [IPR].")

B. Exclusion of the Accused Products Would Not Implicate Public Health, Safety, or Welfare Concerns

The Accused Products do not invoke any specific public health, safety, or welfare concerns. Moreover, the general availability of currently sold and installed barcode scanners or scan engines will not be affected, such that current customers can continue to use their in-field devices.

C. Like Articles are Available to Satisfy Demand for Excluded Accused Products

The technologies embodied in the relevant infringed patents at issue are, and will continue to be, available in Honeywell's full line of Honeywell Barcode Scanners as defined in the accompanying complaint. Thus, any U.S. consumer with a desire for those specific features will have access to ample substitutes containing those features.

As mentioned above, Respondents have a relatively small portion of the U.S. market for barcode scanners or engines. Accordingly, Honeywell and its competitors, including licensees, would easily be able to fill any demand gap felt by the requested remedies, if any. And as is readily apparent from Confidential Exhibit 37 to the Complaint, Honeywell has many licensees to the Asserted Patents thus ensuring both supply and competition in the U.S. market for barcode scanners.

The availability of the Honeywell Barcode Scanners will ensure that, even after the requested remedy is issued, U.S. consumers will still have choices with respect to barcode reading and scanning technology. Moreover, nothing about the desired remedy will impact the availability of existing barcode scanners currently in place in the United States. Accordingly, issuance of the requested remedy will not result in any shortage of barcode scanners or scan engines in the United States.[4]

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[4] *See Certain Agric. Tractors Under 50 Power Take-off Horsepower,* USITC Pub. 3026, Inv. No. 337-TA-380, Comm'n Op., at 34 (Mar. 1997) (concluding that orders at issue had limited economic impact due to considerable competition from other non-infringing goods).

D. There Is Sufficient Capacity to Replace Excluded Accused Products

There is no question that Honeywell or other large market players have the capacity to replace the volume of Accused Products subject to the requested remedial orders within a commercially reasonable time. As stated above, Respondents have a relatively low market share. Thus, there is no indication that excluding the Accused Products will harm the public interest via unmet demand.[5]

E. The Remedy Has No Relevant Public-Interest Impact on U.S. Consumers

As discussed above, even after the requested remedy is issued, customers may purchase and consumers will have access barcode scanners from numerous sources, including Honeywell. Accordingly, the issuance of such relief will have no relevant public interest impact on U.S. consumers.[6]

III. CONCLUSION

For the foregoing reasons, no public-interest concerns preclude the issuance of the proposed remedy against Respondents in this matter.

Dated: May 31, 2019

Respectfully submitted,

M. Scott Stevens
ALSTON & BIRD LLP
950 F Street NW

[5] *See Certain Optical Disk Controller Chips,* Inv. No. 337-TA-506, Comm'n Op., at 61 (Sept. 28, 2005) (issuing remedy where "there is no evidence that the U.S. demand for the covered products cannot be met by other entities, including the Complainants").

[6] *See Digital TV Prods.,* Comm'n Op., at 15-16 (finding that any adverse effect on U.S. consumers resulting from remedy would be minimal, given the range of available products, and would not outweigh the benefit of protecting complainant's IPR).

Washington, DC 20004
Telephone: (202) 239-3025
Facsimile: (704) 654-4825

S. Benjamin Pleune
Stephen R. Lareau
Adam J. Doane
Nicolas C. Marais
ALSTON & BIRD LLP
101 South Tryon Street
Suite 4000
Charlotte, NC 28280
Telephone: (704) 444-1098
Facsimile: (704) 444-1698

Patrick J. Flinn
ALSTON & BIRD LLP
One Atlantic Center
1201 West Peachtree Street
Suite 4900
Atlanta, GA 30309
Telephone: (404) 881-7920
Facsimile: (404) 253-8370

Counsel for Complainants
Honeywell International, Inc.,
Hand Held Products, Inc.,
and Metrologic Instruments, Inc.

U.S. INTERNATIONAL TRADE COMMISSION
WASHINGTON, DC

In the Matter of **CERTAIN BARCODE SCANNERS, SCAN ENGINES, PRODUCTS CONTAINING THE SAME, AND COMPONENTS THEREOF**	**Investigation No. 337-TA-___**

COMPLAINT UNDER SECTION 337 OF
THE TARIFF ACT OF 1930, AS AMENDED

Complainants:

Honeywell International, Inc.
115 Tabor Road
Morris Plains, NJ 07950
Telephone: (877) 841-2840

Hand Held Products, Inc.
9680 Old Bailes Road
Fort Mill, SC 29707
Telephone: (803) 835-8000

Metrologic Instruments, Inc.
9680 Old Bailes Road
Fort Mill, SC 29707
Telephone: (803) 835-8000

Counsel for Complainants:
M. Scott Stevens
ALSTON & BIRD LLP
950 F Street NW
Washington, DC 20004
Telephone: (202) 239-3025

S. Benjamin Pleune
Stephen R. Lareau
Adam J. Doane
Nicholas C. Marais
ALSTON & BIRD LLP
101 South Tryon Street
Charlotte, NC 28280
Telephone: (704) 444-1098

Proposed Respondents:

Opticon, Inc.
2200 Lind Ave. SW
Suite 100
Renton, WA 98057
Telephone: (425) 651-2120

Opticon Sensors Europe B.V.
Opaallaan 35
2132 XV Hoofddorp
The Netherlands
Telephone: +21 23-569 2700

OPTO Electronics Co., Ltd.
12-17, Tsukagoshi 4-chome
Warabi-city Saitama Pref.,
335-0002
Japan
Telephone: +81 48-4461183

Hokkaido Electronic Industry Co., Ltd.
118-122 Kamiashibetsu-cho
Ashibetsu-shi, Hokkaido
Japan
Telephone: +81 48-4461183

Patrick J. Flinn
ALSTON & BIRD LLP
One Atlantic Center
1201 West Peachtree Street
Suite 4900
Atlanta, GA 30309
Telephone: (404) 881-7920
Facsimile: (404) 253-8370

TABLE OF CONTENTS

LIST OF EXHIBITS

Exhibit No.	Description
1	Certified copy of U.S. Patent No. 9,465,970
2	Certified copy of U.S. Patent No. 8,978,985
3	Certified copy of U.S. Patent No. 7,148,923
4	Certified copy of U.S. Patent No. 7,527,206
5	Certified copy of U.S. Patent No. 9,659,199
6	Certified copy of U.S. Patent No. 7,159,783
7	Certified copy of U.S. Patent No. 8,794,520
8	Certified copy of Assignment Record for U.S. Patent No. 9,465,970
9	Certified copy of Assignment Record for U.S. Patent No. 8,978,985
10	Certified copy of Assignment Record for U.S. Patent No. 7,148,923
11	Certified copy of Assignment Record for U.S. Patent No. 7,527,206
12	Certified copy of Assignment Record for U.S. Patent No. 9,659,199[1]
13	Certified copy of Assignment Record for U.S. Patent No. 7,159,783
14	Certified copy of Assignment Record for U.S. Patent No. 8,794,520
15	List of Foreign Counterparts of the Asserted Patents
16	Claim Chart Showing Infringement of U.S. Patent No. 9,465,970
17	Claim Chart Showing Infringement of U.S. Patent No. 8,978,985
18	Claim Chart Showing Infringement of U.S. Patent No. 7,148,923
19	Claim Chart Showing Infringement of U.S. Patent No. 7,527,206
20	Claim Chart Showing Infringement of U.S. Patent No. 9,659,199
21	Claim Chart Showing Infringement of U.S. Patent No. 7,159,783
22	Claim Chart Showing Infringement of U.S. Patent No. 8,794,520
23	Information regarding Proposed Respondents
24	Information regarding Opticon L-50X Scanner (Datasheet and User Guides)
25	Information regarding Opticon MDI-3100 Scan Engine (Datasheets and User Guides)
26	Declaration of Stephen Lareau
27	Photographs of Opticon's L-50X Scanner
28	Claim Chart Showing Honeywell Xenon 1902g Practices U.S. Patent No. 9,465,970
29	Claim Chart Showing Honeywell Xenon 1902g Practices U.S. Patent No. 8,978,985
30	Claim Chart Showing Honeywell Xenon 1902g Practices U.S. Patent No. 7,148,923
31	Claim Chart Showing Honeywell Xenon 1902g Practices U.S. Patent No. 7,527,206
32	Claim Chart Showing Honeywell Xenon 1902g Practices U.S. Patent No. 9,659,199

[1] With the original complaint, Honeywell is submitting a non-certified version of the assignment record relevant to U.S. Patent No. 9,659,199. Honeywell has placed an order for the certified version and will submit it as soon as it is received from the U.S. Patent and Trademark Office.

33	Claim Chart Showing Honeywell Xenon 1902g Practices U.S. Patent No. 7,159,783
34	Claim Chart Showing Honeywell Xenon 1902g Practices U.S. Patent No. 8,794,520
35	Information regarding the Honeywell Xenon 1902g (Datasheet and User Guide)
36	Photographs of Honeywell Xenon 1902g
37	Confidential List of Licensees to Asserted Patents
38	Confidential Declaration of Heath Martin

LIST OF PHYSICAL EXHIBITS

Exhibit No.	Description
P1	Physical sample of a domestic article protected by at least one of the Asserted Patents: Honeywell Xenon 1902g
P2	Physical sample of the following imported article that is a subject of the Complaint: Opticon L-50X Scanner

LIST OF APPENDICES

Appendix	**Description**
App. A	Certified copy of Prosecution History of U.S. Patent No. 9,465,970[2]
App. B	Certified copy of Prosecution History of U.S. Patent No. 8,978,985
App. C	Certified copy of Prosecution History of U.S. Patent No. 7,148,923
App. D	Certified copy of Prosecution History of U.S. Patent No. 7,527,206
App. E	Certified copy of Prosecution History of U.S. Patent No. 9,659,199
App. F	Certified copy of Prosecution History of U.S. Patent No. 7,159,783
App. G	Certified copy of Prosecution History of U.S. Patent No. 8,794,520
App. H	Copy of References Cited in Prosecution History of U.S. Patent No. 9,465,970
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App. M	Copy of References Cited in Prosecution History of U.S. Patent No. 7,159,783
App. N	Copy of References Cited in Prosecution History of U.S. Patent No. 8,794,520

[2] With the original complaint, Honeywell is submitting non-certified versions of the file histories for Appendices A, B, E, F, and G. Honeywell has placed orders for the certified versions of these file histories and will submit them as soon as they are received from the U.S. Patent and Trademark Office.

I. INTRODUCTION

1. Honeywell International, Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. (collectively, "Honeywell" or "Complainants") file this complaint pursuant to Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337 ("Section 337"), based on the unlawful importation into the United States, the sale for importation into the United States, and/or the sale within the United States after importation of certain barcode scanners, scan engines, products containing the same, and components thereof.

2. The proposed Respondents are Opticon Inc., Opticon Sensors Europe B.V., OPTO Electronics Co., Ltd., and Hokkaido Electronic Industry Co., Ltd. (collectively, "Opticon" or "Respondents").

3. The complaint is directed to Respondents' imported barcode scanners, scan engines, products containing the same, and components thereof, including but not limited to, at least Opticon's L-50X, PX-20, L-46X, M-10, OPN-2006, and OPN-3002i scanners and Opticon's MDI-3100, MDI-4100, MDI-4050, and MDI-4150 scan engines, that infringe the following claims:

U.S. Patent No.	Asserted Claims	Accused Products[3]
9,465,970	**1**, 2, 4-10, 13-21, **22**, 23, 25-31, 34-42, **43**, 44, 46-52, 55-63, **85**	At least L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150
8,978,985	**1**, 2, 4-9, **12**, 13, 15-21, **22**, and 23-27	At least L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150

[3] The identification of a specific model or type of barcode reader or scan engine is not intended to limit the scope of the investigation. Discovery may reveal that additional Opticon products infringe the Asserted Patents' claims and/or that additional claims are infringed, and any remedy should extend to all barcode readers, barcode scanners, scan engines, products containing the same, and components thereof.

U.S. Patent No.	Asserted Claims	Accused Products[3]
7,148,923	**1**, 2-6, 8, **10**, **19**, 20-28, **29**, and 30-33	At least L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150
7,527,206	**1**, 2-3, **11**, 12-14, 17, 19, **20**, 21-23, 26, and 28	At least L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-/4050, and MDI-4150
9,659,199	**1**, 2-7, **8**, 9-13, **14**, and 15-20	At least L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150
7,159,783	**9**, 10-19, and **20**	At least L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150
8,794,520	**1**, 2-17, **18**, 19-24, **25**, 26, and **27**	At least L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150

As shown above, the same set of Accused Products are alleged to infringe all of the Asserted Patents. Of the Asserted Patents, five provide technology helping to properly expose an image of a barcode, including two from the same family covering global shutter technology. The other two Asserted Patents relate to the scanner's operating system and certain features thereof.

4. The Accused Products are manufactured and/or sold for importation into the United States, imported into the United States, and/or sold after importation into the United States by or on behalf of Respondents.

5. An industry as required by 19 U.S.C. §§ 1337(a)(2) and (3) exists in the United States relating to articles protected by the Asserted Patents.

6. Honeywell seeks as relief a permanent limited exclusion order prohibiting entry into the United States of Respondents' infringing barcode scanners, scan engines, products containing the same, and components thereof. Honeywell requests that such an exclusion order prohibit Respondents from importing into the United States key components of the accused

barcode scanners, such as scan engines, imaging modules, circuit boards, and flash memory modules, so as to prevent Respondents from evading any exclusion order directed to its barcode scanners and scan engines.

7. Honeywell also requests permanent cease and desist orders prohibiting Respondents from importing, admitting or withdrawing from a foreign trade zone, marketing, advertising, demonstrating, warehousing inventory, distributing, offering for sale, selling, licensing, repairing, programming, packaging, repackaging, bundling, or updating its certain barcode scanners, scan engines, products containing the same, and components thereof.

8. Honeywell also requests that the Commission require an appropriate bond be posted for any activities otherwise covered by the permanent limited exclusion order and/or permanent cease and desist orders during the Presidential review period.

II. COMPLAINANTS

A. Honeywell International, Inc.

9. Honeywell International, Inc. is a corporation organized and existing under the laws of the State of Delaware, having a principal place of business at 115 Tabor Road, Morris Plains, NJ 07950. Honeywell has announced that it is relocating its corporate headquarters to Charlotte, NC.

10. The corporation known today as Honeywell traces its roots to 1904 and an engineer named Mark Honeywell from Wabash, Indiana who developed and installed the first hot-water-heating system in the United States. Honeywell would later play a key role in U.S. war efforts, inventing and manufacturing the first electronic autopilot system, which proved to be a turning point in World War II. After entering the computer business through a merger with Raytheon

Corporation in 1957, Honeywell developed and engineered the instruments that safely landed Neil Armstrong and Buzz Aldrin on the moon.

11. In 1999, Honeywell and AlliedSignal merged. AlliedSignal was formed in 1920 in response to a shortage of drugs and chemicals during World War I. Germany controlled a majority of the world's chemical industry, which led to dramatic shortages during the war. AlliedSignal quickly became a leading producer of various chemicals and would eventually enter the aerospace, automotive, and engineered-materials businesses through mergers with prominent American corporations such as Signal Companies and Union Texas Natural Gas. At present, Honeywell is headquartered in Morris Plains, New Jersey and employs, in conjunction with its subsidiaries, approximately 43,000 employees in the United States.

12. Research is one of the keys to Honeywell's success and provides the necessary cornerstone for its cutting-edge products. Operating 150 research and engineering facilities globally, Honeywell employs over 12,000 engineers and over 14000 software developers domestically. As of early 2019, Honeywell had over 25,000 granted patents and over 11,000 patent applications stemming from its R&D work.

13. Since the 1960s, Honeywell and its subsidiaries have spent tens of millions of dollars in U.S. expenditures related to the development, testing, product support, repair, and service of its barcode scanning product lines, which, *inter alia*, embody the innovations of the Asserted Patents and many other patents in Honeywell's patent portfolio. These expenditures and efforts demonstrate Honeywell's commitment to bringing state-of-the-art barcode scanning equipment to U.S. consumers and businesses.

B. Hand Held Products, Inc.

14. Hand Held Products, Inc. ("Hand Held") is a corporation organized under the laws of Delaware, with its principal place of business at 9680 Old Bailes Road, Fort Mill, SC 29707. Hand Held is a wholly owned subsidiary of Honeywell International, Inc. Hand Held is relocating its corporate headquarters to Charlotte, NC later in 2019.

15. Hand Held was founded in Charlotte, North Carolina and provided barcode reading and image collection solutions for a variety of applications including mobile, wireless, and transaction processing. One of Hand Held's feature products was the Dolphin handheld computer, which included both laser barcode scanning and image capture technology. Hand Held would eventually merge with Honeywell in late 2007 and operated as the Honeywell Scanning & Mobility division.

16. Hand Held has developed and sells a diverse range of products, which cover a spectrum of industries and solutions. These products include barcode scanners, computer devices, printers, wearable technology, software, and RFID devices. These devices provide innovative solutions for factories, healthcare and manufacturing facilities, and retail. As a result of Hand Held's innovative design and product features, its products have become commonplace in hospitals and other healthcare facilities because of their reliability, accuracy, and versatility.

17. Hand Held owns approximately 1,400 granted patents and approximately 500 pending patent applications. These patents/patent applications cover a wide range of technologies relating to cellular phones, barcode scanners, wearable technology, human interface devices, and various components thereof.

C. Metrologic Instruments, Inc.

18. Metrologic Instruments, Inc. ("Metrologic") is a corporation organized under the laws of New Jersey, with its principal place of business at 9680 Old Bailes Road, Fort Mill, SC 29707. Metrologic is a wholly owned subsidiary of Honeywell International, Inc. Metrologic is relocating its corporate headquarters to Charlotte, NC later in 2019.

19. Metrologic was founded in 1968. In the 1970s with the rise in popularity of barcode scanners, Metrologic entered the industry, developing the first hand-held laser barcode scanner, known as the X-scanner. After decades of research and development, Metrologic debuted the Voyager barcode scanner in 2000, which featured push-button data transmission. The Voyager had the ability to act both as a handheld scanner and as a presentation scanner while cradled and quickly became one of the best-selling barcode scanners and remains an industry leader to this day. In the spring of 2008, Metrologic joined forces with Honeywell, officially becoming a part of, along with Hand Held, Honeywell Scanning & Mobility in 2009.

20. Metrologic is an industry leader in data capture and collection hardware and software. During the birth of the Universal Product Code, Metrologic introduced triggerless, omnidirectional, and mini-slot scanners into the retail market to help read and decode these new barcodes. Since these breakthroughs, Metrologic's technologies have included barcode computing, software for barcode scanners optimization, and wireless communication network infrastructure. Today, Metrologic owns approximately 350 granted patents and approximately 25 pending patent applications. These patents cover a wide variety of technologies in the areas of laser and imaging technologies.

III. PROPOSED RESPONDENTS

A. Opticon, Inc.

21. Proposed Respondent Opticon, Inc. ("Opticon USA") is a company organized and existing under the laws of the State of Delaware, having a principal place of business at 2220 Lind Ave. SW, Suite 100, Renton, WA 98057-3327. Opticon USA, among other things, is engaged in the importation into the United States and sale after importation into the United States of barcode scanners and scan engines, including the Accused Products.

22. Upon information and belief, Opticon USA imports and sells after importation all or a substantial portion of the Accused Products.

23. Upon information and belief, Opticon USA is a direct or indirect subsidiary of OPTO Electronics Co., Ltd.

24. Additional information concerning Opticon USA may be found on its website, available at http://www.opticonusa.com.

B. Opticon Sensors Europe B.V.

25. Proposed Respondent Opticon Sensors Europe B.V. ("Opticon Sensors") is, upon information and belief, a company organized and existing under the laws of The Netherlands, having a principal place of business at Opaallaan 35, 2132 XV Hoofddorp, Netherlands.

26. Upon information and belief, Opticon Sensors, among other things, is engaged in overseeing and/or arranging the manufacture of the Accused Products, overseeing and/or arranging the importation of the Accused Products, as well as the sale for importation and the importation into the United States of barcode scanners and scan engines, including the Accused Products.

27. For example, Opticon Sensors's website states that it "has several central activities besides [ex-US] sales, such as logistics and technical engineering. . . . The technical departments

consist of production, research and development for hardware and software, technical support, and a service department." Ex. 23.

28. Upon information and belief, Opticon Sensors is a direct or indirect subsidiary of OPTO Electronics Co., Ltd.

29. Additional information concerning OPTO may be found on its website, available at https://opticon.com/countries/netherlands/ .

C. OPTO Electronics Co., Ltd.

30. Proposed Respondent OPTO Electronics Co., Ltd. ("OPTO") is, upon information and belief, a company organized and existing under the laws of Japan, having a principal place of business at 12-17, Tsukagoshi 4-chrome, Warabi-city Saitama Pref., 335-0002, Japan.

31. Upon information and belief, OPTO, among other things, is engaged in overseeing and/or arranging the manufacture of the Accused Products, as well as the sale for importation and the importation into the United States of barcode scanners, including the Accused Products.

32. For example, OPTO's website states that, "Product manufacturing is managed through our Japanese office, OPTO Electronics Co. Ltd., which uses a major ISO-certified production facility." Ex. 23.

33. Additional information concerning OPTO may be found on its website, available at https://opticon.com/countries/japan/.

D. Hokkaido Electronic Industry Co., Ltd.

34. Proposed Respondent Hokkaido Electronic Industry Co., Ltd. ("Hokkaido") a/k/a Hokkaido Electronic Co., Ltd. and Hokkaido Electronics Industrial Co., Ltd. is, upon information and belief, a company organized and existing under the laws of Japan, having a principal place of business at 118-122 Kamiashibetsu-cho, Ashibetsu-shi, Hokkaido, Japan.

35. Upon information and belief, Hokkaido, among other things, is engaged in the manufacture of the Accused Products as well as the sale for importation into the United States of barcode scanners and scan engines, including the Accused Products.

36. For example, Hokkaido's ISO 9001 certificate states that its scope is: "THE MANUFACTURE OF BARCODE SCANNER, WIRELESS BARCODE SCANNER AND MODULE FOR BARCODE SCANNER." Ex. 23.

37. For example, OPTO's public filings indicate that Hokkaido performs at least a portion of the "Manufacture of our group products." Ex. 23.

38. Upon information and belief, Hokkaido is a direct or indirect subsidiary of OPTO Electronics Co., Ltd.

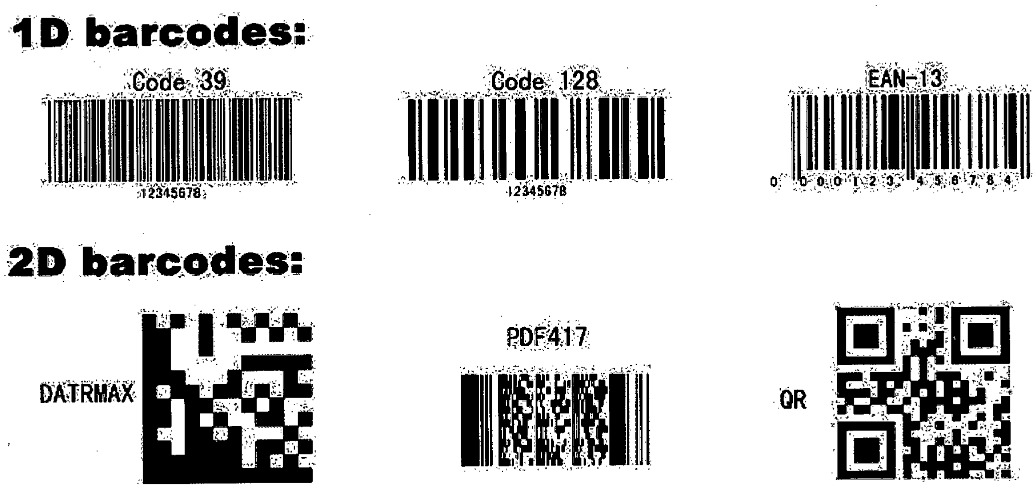
E. Statement Regarding Additional Potential Respondents

39. According to OPTO, certain of its "products are outsourced to several overseas companies outside the [OPTO] group." Ex. 23. The identity or identities of these additional manufacturers of Accused Products, who upon information and belief then sell the Accused Products for importation into the United States, are unknown to Complainants at this time. Complainants reserve the right to move to add additional respondents should discovery identify additional manufacturers.

IV. THE TECHNOLOGY AND ACCUSED PRODUCTS AT ISSUE

40. The Asserted Patents, described in more detail below, are a reflection of the breadth of Honeywell's extensive dedication and investment in barcode scanning technology. Ever since the 1960s, Honeywell has strived to provide its customers with cutting-edge bar code scanning devices.

41. Early barcode scanners were designed only to read linear, one-dimensional (1D) barcodes. 1D barcodes use a series of lines and spaces and variable lengths to encode data. These linear barcodes can contain only a handful of characters. Accordingly, to encode longer strings of data, a 1D barcode would need to be physically enlarged or extended, which is not suitable for all circumstances.



42. As a result, various two-dimensional (2D) barcodes, which use shapes, as opposed to lines, to encode data were designed. Because data can be encoded based both on a vertical and horizontal arrangement of shapes, 2D barcodes can encode exponentially more data in the same amount of space compared to their 1D counterparts.

43. The advent of 2D barcodes ushered in a new era and a new need for advanced barcode scanners that could decode these complex arrangements of shapes and sizes. As a pioneer in advanced 2D barcode scanners, Honeywell developed an array of products with technologies that allowed barcode scanners to seamlessly read 2D and 1D barcodes. Because of the complexity of 2D barcodes and the complexity in reading such barcodes, even the slightest change in lighting, user hand-jitter, or angle of scanning can dramatically affect the ability to effectively and efficiently decode these barcodes. This complexity, coupled with the need for speed of decoding

especially in healthcare, retail, and manufacturing settings, underscores the importance of Honeywell's technological advances.

44. One of Honeywell's key innovations was the development of global-shutter technology in CMOS-based barcode scanners. Traditionally, CMOS image sensors used a rolling shutter technique in which individual rows of pixels in the image sensor were activated and read out in sequence. This meant that, for example, the top row of pixels in the image sensor was exposed before the bottom row of pixels. Because rolling shutter involved the exposing rows of pixels sequentially at different times, rolling shutter suffers from two disadvantages: image distortion and image blur. To overcome these drawbacks, Honeywell engineers developed the use of global shutter technology in the CMOS image sensor, in which all or substantially all of the pixels are simultaneously exposed. Exposing all pixels in the sensor simultaneously addresses each drawback because pixels are not exposed at different points in times during image capture. Products incorporating global shutter were and still are far superior to scan engines utilizing rolling shutter, and this innovation resulted in significant commercial success for Honeywell's global-shutter products.

45. Honeywell has developed technology and software programming that allows these barcode scanners to adjust automatically, in real-time, to various environmental conditions. For example, Honeywell developed barcode scanners that can adjust exposure (light) settings on a frame-by-frame basis, which allows a barcode reader to capture higher-quality images. An addition innovation was the development of barcode readers capable of adjusting exposure settings in a real-time fashion in a multitasking operation system environment. Honeywell also developed barcode reader technology that improves the user experience by reducing apparent flicker from the illumination LEDs that are utilized during scanning operations while also improving the ability of the reader to read images on LCD screens. Moreover, Honeywell developed barcode reader

technology that allows the reader to determine the location of a barcode within the frame and use information regarding the quality of the image at that location in order to obtain an improved subsequent image. One Honeywell innovation even allows barcode scanners to be customized using a script-interpreter program. Combined, these technologies lead to faster decode time and more accurate, concise character output. Barcode scanners, because of Honeywell's advancements, can now quickly decode any type of barcode, regardless of environment, and can automatically adjust to different users to provide quick and accurate scanning and decoding.

46. The Accused Products are certain Opticon barcode scanners, scan engines, products containing the same, and components thereof that incorporate, without authorization, certain of Honeywell's technologies as set forth and claimed in the Asserted Patents.

47. In accordance with Rule 210.12(a)(12), the Accused Products fall into the categories of products that are generally known in plain English as: "barcode scanners, barcode readers, barcode decoders, stationary scanners, handheld scanners, companion scanners, cabled scanners, wireless scanners, mobile scanning devices, handheld computers, and/or scan engines."

V. THE ASSERTED PATENTS AND NON-TECHNICAL DESCRIPTION OF THE INVENTIONS[4]

A. Ownership of the Asserted Patents

48. Hand Held Products, Inc. owns the entire right, title, and interest to the 970 Patent. A certified copy of the assignment records for the 970 Patent, as maintained by the USPTO, is attached as Exhibit 8.

[4] All non-technical descriptions of the inventions herein are presented to give a general background of those inventions. Such statements are not intended to be used, nor should be used, for purposes of patent claim interpretation. Complainants present these statements subject to, and without waiver of, their right to argue that claim terms should be construed in a particular way, as contemplated by claim interpretation jurisprudence and the relevant evidence.

49. Hand Held Products, Inc. owns the entire right, title, and interest to the 985 Patent. A certified copy of the assignment records for the 985 Patent, as maintained by the USPTO, is attached as Exhibit 9.

50. Hand Held Products, Inc. owns the entire right, title, and interest to the 923 Patent. A certified copy of the assignment records for the 923 Patent, as maintained by the USPTO, is attached as Exhibit 10.

51. Metrologic Instruments, Inc. owns the entire right, title, and interest to the 206 Patent. A certified copy of the assignment records for the 206 Patent, as maintained by the USPTO, is attached as Exhibit 11.

52. Hand Held Products, Inc. owns the entire right, title, and interest to the 199 Patent. A certified copy of the assignment records for the 199 Patent, as maintained by the USPTO, is attached as Exhibit 12.

53. Hand Held Products, Inc. owns the entire right, title, and interest to the 783 Patent. A certified copy of the assignment records for the 783 Patent, as maintained by the USPTO, is attached as Exhibit 13.

54. Hand Held Products, Inc. owns the entire right, title, and interest to the 520 Patent. A certified copy of the assignment records for the 520 Patent, as maintained by the USPTO, is attached as Exhibit 14.

B. U.S. Patent No. 9,465,970

55. The 970 Patent, entitled "Image Reader Comprising CMOS Based Image Sensor Array," issued on October 11, 2016, naming inventors Ynjiun P. Wang and William H. Havens. The 970 Patent issued from U.S. Patent Application Serial No. 14/221,903, filed on March 21,

2014, and expires on March 11, 2025. The first maintenance fee window for the 970 Patent opens on October 11, 2019.

56. A certified copy of the 970 Patent is attached as Exhibit 1.

57. A certified copy[5] of the prosecution history of the 970 Patent, as maintained by the United States Patent and Trademark Office ("USPTO"), and copies of each reference cited in the 970 Patent and its prosecution history are included in Appendices A and H, respectively.

58. The 970 Patent has 107 claims, 5 of which are independent claims. Complainants assert claims **1**, 2, 4-10, 13-21, **22**, 23, 25-31, 34-42, **43**, 44, 46-52, 55-63, and **85**.

59. The 970 Patent discloses, for example, an apparatus using a CMOS image sensor in a global-shutter mode to decode a bar code. Barcode reading benefits from the exposure of substantially all of the pixels in the image sensor. But traditionally, CMOS-based image readers have employed rolling shutters whereby one row of pixels is exposed at a time, resulting in image distortion and image blur. The technology of the 970 Patent allows for the use of global-shutter technology to expose substantially all of the pixels at once in a CMOS-based image sensor, limiting image distortion and blur. This allows for barcodes to be read more accurately and quickly.

C. U.S. Patent No. 8,978,985

60. The 985 Patent, entitled "Image Reader Comprising CMOS Based Image Sensor Array," issued on March 17, 2015, naming inventors Ynjiun P. Wang and William H. Havens. The 985 Patent issued from U.S. Patent Application Serial No. 14/273,631, filed on May 19, 2014, and expires on March 11, 2025. All maintenance fees due have been timely paid for the 985 Patent.

[5] With the original complaint, Honeywell is submitting non-certified versions of the file histories for Appendices A, B, E, F, and G. Honeywell has placed orders for the certified versions of these file histories and will submit them as soon as they are received from the U.S. Patent and Trademark Office.

61. A certified copy of the 985 Patent is attached as Exhibit 2.

62. A certified copy of the prosecution history of the 985 Patent, as maintained by the USPTO, and copies of each reference cited in the 985 Patent and its prosecution history are included in Appendices B and I, respectively.

63. The 985 Patent has 27 claims, 3 of which are independent claims. Complainants assert claims **1**, 2, 4-9, **12**, 13, 15-21, **22**, and 23-27.

64. The 985 Patent discloses, for example, a barcode reading device using a CMOS image sensor in a global-shutter mode to decode a 1D or 2D barcode. Barcode reading benefits from the exposure of substantially all of the pixels in the image sensor. But traditionally, CMOS-based image readers have employed rolling shutters whereby one row of pixels is exposed at a time, resulting in image distortion and image blur. Also, prior-art barcode reading devices have had difficulty reading all 1D and 2D barcodes. The technology of the 985 Patent allows for the use of global-shutter technology to expose substantially all of the pixels at once in a CMOS-based image sensor, limiting image distortion and blur. This allows for both 1D and 2D barcodes to be read more accurately and quickly.

D. U.S. Patent No. 7,148,923

65. The 923 Patent, entitled "Methods and Apparatus for Automatic Exposure Control," issued on December 12, 2006, naming inventors Jeffrey D. Harper, Robert M. Hussey, Matthew W. Pankow, and Timothy P. Meier. The 923 Patent issued from U.S. Patent Application Serial No. 09/903,300, filed on July 11, 2001, and expires on October 19, 2021. All maintenance fees due have been paid for the 923 Patent.

66. A certified copy of the 923 Patent is attached as Exhibit 3.

67. A certified copy of the prosecution history of the 923 Patent, as maintained by the USPTO, and copies of each reference cited in the 923 Patent and its prosecution history are included in Appendices C and J, respectively.

68. The 923 Patent has 33 claims, 6 of which are independent claims. Complainants assert claims **1**, 2-6, 8, **10**, **19**, 20-28, **29**, and 30-33.

69. The 923 Patent discloses, for example, a device and method for automated exposure control in a multi-tasking environment. Exposure, in imaging, is a measure of the amount of light per unit area in a particular space, and to accurately read barcodes, a scanner needs to be able to alter the exposure based on environmental conditions. The technology of the 923 Patent allows for the adjustment of exposure settings in an imaging device in a real-time fashion, using distinct modules, so that the exposure setting is accurate for the particular image being captured. This technology allows for the reading of data from a wider range of products that may be of different size, shape, and material construction.

E. U.S. Patent No. 7,527,206

70. The 206 Patent, entitled "Method of Setting the Time Duration of Illumination From an LED-Based Illumination Array Employed in a Digital Imaging-Based Code Symbol Reader, Using an Image-Processing Based Illumination Metering Program Executed Therewithin," issued on May 5, 2009, naming inventors Xiaoxun Zhu, Yong Liu, Ka Man Au, Rui Hou, Hongpeng Yu, Xi Tao, Liang Liu, Wenhua Zhang, and Anatoly Kotlarsky. The 206 Patent issued from U.S. Patent Application Serial No. 11/607,114, filed on November 30, 2006, and expires on November 13, 2023. All maintenance fees due have been timely paid for the 206 Patent.

71. A certified copy of the 206 Patent is attached as Exhibit 4.

72. A certified copy of the prosecution history of the 206 Patent, as maintained by the USTPO, and copies of each reference cited in the 206 Patent and its prosecution history are included in Appendices D and K, respectively.

73. The 206 Patent has 28 claims, 3 of which are independent claims. Complainants assert claims **1**, 2-3, **11**, 12-14, 17, 19, **20**, 21-23, 26, and 28.

74. The 206 Patent discloses, for example, a barcode reader with a modified imaging sensor to adjust to varied light conditions based on the environment around the barcode and reader. Historically, barcode scanners would use integrated illumination subsystems, which limited the capability to read large and highly dense barcodes. The technology of the 206 Patent allows real-time measuring and correction of added illumination duration for subsequent image capture. This allows for barcodes to be read more clearly and accurately.

F. U.S. Patent No. 9,659,199

75. The 199 Patent, entitled "Terminal with Flicker-Corrected Aimer and Alternating Illumination," issued on May 23, 2017, naming inventors Daniel Van Volkinburg, Stephen Patrick Deloge, Kevin Bower, Matthew Pankow, and Ryan Kather. The 199 Patent issued from U.S. Patent Application Serial No. 15/176,366, filed on June 8, 2016, and expires on January 31, 2031. The first maintenance fee window for the 199 Patent opens on March 23, 2020.

76. A certified copy of the 199 Patent is attached as Exhibit 5.

77. A certified copy of the prosecution history of the 199 Patent, as maintained by the USPTO, and copies of each reference cited in the 199 Patent and its prosecution history are included in Appendices E and L, respectively.

78. The 199 Patent has 20 claims, 3 of which are independent claims. Complainants assert claims **1**, 2-7, **8**, 9-13, **14**, and 15-20.

79. The 199 Patent discloses, for example, a device and method for activating a screen reading mode with reduced flickering to read an indicia. Traditionally, barcode scanners used illumination to read any barcode for greater image clarity and exposure overall decoding speed. Using illumination on a screen, however, can cause specular reflection resulting in an unreadable barcode. The 199 Patent allows for a screen reading mode with an alternating illumination where there is an exposure period without illumination. It also allows for illumination at specific intervals to reduce flickering effects which can result in a noticeable change in illumination brightness. This allows for barcode scanners to read screens such as, for example, phone mobile-device screens.

G. U.S. Patent No. 7,159,783

80. The 783 Patent, entitled "Customizable Optical Reader," issued on January 9, 2007, naming inventors Joseph Walczyk, Dieter Fauth, David Holzhauer, Robert M. Hussey, Barry Keys, Joseph Livingston, and Michael D. Robinson. The 783 Patent issued from U.S. Patent Application Serial No. 11/203,667, filed on August 12, 2005, and expires on March 28, 2023. All maintenance fees due have been timely paid for the 783 Patent.

81. A certified copy of the 783 Patent is attached as Exhibit 6.

82. A certified copy of the prosecution history of the 783 Patent, as maintained by the USPTO, and copies of each reference cited in the 783 Patent and its prosecution history are included in Appendices F and M, respectively.

83. The 783 Patent has 20 claims, 3 of which are independent claims. Complainants assert claims **9**, 10-19, and **20**.

84. The 783 Patent discloses, for example, a device and method of customizing an optical reader. Historically, optical readers output a specific string as programmed into the barcode. The 783 patent allows a user to configure the optical reader using a script interpreter

program to output an edited string that may differ from the original string programmed into the barcode. This allows customization of an optical reader in a manner consistent with the user's particular application.

H. U.S. Patent No. 8,794,520

85. The 520 Patent, entitled "Method and Apparatus for Operating Indicia Reading Terminal Including Parameter Determination," issued on August 5, 2014, naming inventors Ynjiun P. Wang and Shulan Deng. The 520 Patent issued from U.S. Patent Application Serial No. 12/242,244, filed on September 30, 2008, and expires on June 21, 2029. All maintenance fees due have been timely paid for the 520 Patent.

86. A certified copy of the 520 Patent is attached as Exhibit 7.

87. A certified copy of the prosecution history of the 520 Patent, as maintained by the USPTO, and copies of each reference cited in the 520 Patent and its prosecution history are included in Appendices G and N, respectively.

88. The 520 Patent has 27 claims, 4 of which are independent claims. Complainants assert claims **1**, 2-17, **18**, 19-24, **25**, 26, and **27**.

89. The 520 Patent discloses, for example, a device and method of determining a parameter in a hand-held barcode reader. Historically, to determine, for example, an exposure parameter, a sample of pixel values could be derived from the frame and averaged to determine the frame white level. When a significant portion of the background is white, or black, however, the determined parameter may be inaccurate, which may result in misreads. The 520 Patent allows the barcode reader to determine a location of a barcode, and derive a parameter from a sample of pixels from that location. This allows for a significant reduction in misreads.

I. Foreign Counterparts of the Asserted Patents

90. A list of each foreign patent, each foreign patent application, and each foreign application that has been denied, abandoned, or withdrawn corresponding to the Asserted Patents, with an indication of the prosecution status of each such foreign patent application, is attached as Exhibit 15. Honeywell is aware of no other foreign patent, foreign patent application, or foreign application that has been denied, abandoned, or withdrawn corresponding to the Asserted Patents.

J. Licensees Under the Asserted Patents

91. Any party that may be licensed to one or more of the Asserted Patents is identified in Confidential Exhibit 37.

VI. RESPONDENTS' UNLAWFUL AND UNFAIR ACTS

92. As discussed in detail below, the Accused Products are barcode scanners, scan engines, products containing the same, and components thereof, that infringe the Asserted Patents and are manufactured abroad by or for Opticon and sold for importation into the United States, imported into the United States, and/or sold within the United States after importation, at least in part by Opticon. Information regarding representative Accused Products discussed below can be found in Exhibits 24-25.

93. Opticon directly infringes, contributes to the infringement of, and/or induces the infringement of claims **1**, 2, 4-10, 13-21, **22**, 23, 25-31, 34-42, **43**, 44, 46-52, 55-63, and **85** of the 790 Patent with respect to at least its L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150 products.

94. An exemplary claim chart showing infringement of independent claims 1, 22, 43, and 85 of the 790 Patent by Opticon's L-50X, which is representative of the Accused Products, is attached as Exhibit 16.

95. Opticon directly infringes, contributes to the infringement of, and/or induces the infringement of claims **1**, 2, 4-9, **12**, 13, 15-21, **22**, and 23-27 of the 985 Patent with respect to at least its L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150 products.

96. An exemplary claim chart showing infringement of independent claims 1, 12, and 22 of the 985 Patent by Opticon's L-50X, which is representative of the Accused Products, is attached as Exhibit 17.

97. Opticon directly infringes, contributes to the infringement of, and/or induces the infringement of claims **1**, 2-6, 8, **10**, **19**, 20-28, **29**, and 30-33 of the 923 Patent with respect to at least its L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150 products.

98. An exemplary claim chart showing infringement of independent claims 1, 10, 19, and 29 of the 923 Patent by Opticon's L-50X, which is representative of the Accused Products, is attached as Exhibit 18.

99. Opticon directly infringes, contributes to the infringement of, and/or induces the infringement of claims **1**, 2-3, **11**, 12-14, 17, 19, **20**, 21-23, 26, and 28 of the 206 Patent with respect to at least its L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150 products.

100. An exemplary claim chart showing infringement of independent claims 1, 11, and 20 of the 206 Patent by Opticon's L-50X, which is representative of the Accused Products, is attached as Exhibit 19.

101. Opticon directly infringes, contributes to the infringement of, and/or induces the infringement of claims **1**, 2-7, **8**, 9-13, **14**, and 15-20 of the 199 Patent with respect to at least its

L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150 products.

102. An exemplary claim chart showing infringement of independent claims 1, 8, and 14 of the 199 Patent by Opticon's L-50X, which is representative of the Accused Products, is attached as Exhibit 20.

103. Opticon directly infringes, contributes to the infringement of, and/or induces the infringement of claims **9**, 10-19, and **20** of the 783 Patent with respect to at least its L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150 products.

104. An exemplary claim chart showing infringement of independent claims 9 and 20 of the 783 Patent by Opticon's L-50X, which is representative of the Accused Products, is attached as Exhibit 21.

105. Opticon directly infringes, contributes to the infringement of, and/or induces the infringement of claims **1**, 2-17, **18**, 19-24, **25**, 26, and **27** of the 520 Patent with respect to at least its L-50X, PX-20, L-46X, M-10, OPN-2006, OPN-3002i, MDI-3100, MDI-4100, MDI-4050, and MDI-4150 products.

106. An exemplary claim chart showing infringement of independent claims 1, 18, 25, and 27 of the 520 Patent by Opticon's L-50X, which is representative of the Accused Products, is attached as Exhibit 22.

A. Direct Infringement

107. Respondents directly infringe the Asserted Patents through their manufacture, sale for importation, importation, and/or sale after importation of the Accused Products.

108. On information and belief, Respondents manufacture the Accused Products abroad, including in Japan and China, and then sell those Accused Products for importation into the United States.

109. On information and belief, Opticon imports into the United States all of the Accused Products.

110. Opticon directly and through authorized agents, sells and offers for sale the Accused Products within the United States to end users.

111. On information and belief, Opticon tests or operates the Accused Products in the United States, thereby performing the claimed methods and directly infringing any asserted claims of the Asserted Patents requiring such operation. Similarly, Opticon's customers and the end users of the Accused Products test and/or operate the Accused Products in the United States, in accordance with Opticon's instruction contained in, for example, its user manuals, thereby also performing the claimed methods and directly infringing the asserted claims of the Asserted Patents requiring such operation.

B. Contributory Infringement

112. Respondents also contribute to infringement of the Asserted Patents by selling for importation into the United States, importing into the United States, and/or or selling within the United States after importation the Accused Products, the non-staple constituent parts of those devices, which are not suitable for substantial non-infringing use and which embody a material part of the inventions described in the Asserted Patents. On information and belief, these devices are known by Respondents to be especially made or especially adapted for use in the infringement of the Asserted Patents.

113. Specifically, upon information and belief, Opticon sells the Accused Products to resellers and end users with knowledge that the devices infringe. End users of the barcode scanners directly infringe the Asserted Patents.

114. Respondents have had notice of the Asserted Patents and Honeywell's claims of infringement of each since no later than the service of this Complaint. Despite having notice of the Asserted Patents and its infringement of the Asserted Patents, Respondents have continued their unlawful activities and expanded those activities by launching new infringing products.

C. Induced Infringement

115. Respondents also induced, and continue to induce, infringement of the Asserted Patents by encouraging and facilitating others to perform acts known by Respondents to infringe the Asserted Patents with the specific intent that those performing the acts infringe the Asserted Patents. Upon information and belief, Opticon did so with knowledge of the Asserted Patents. Opticon, upon information and belief, among other things, advertises the Accused Products, publishes datasheets and promotional literature describing the operation of those devices, creates and/or distributes user manuals for the Accused Products, and offers support and technical assistance to its customers designed to induce those customers to perform the specific acts of direct infringement. On information and belief, these materials instruct and encourage users to use Opticon's Accused Products in a manner that infringes the asserted claims.

VII. SPECIFIC INSTANCES OF UNFAIR IMPORTATION AND SALE

116. Respondents sell for importation into the United States, import into the United States, and/or sell after importation into the United States the Accused Products. An example of an Accused Product was purchased from a retailer in the United States. *See* Exhibits 26-27.

117. Opticon's Accused Products are manufactured abroad, sold for importation into the United States, imported into the United States, and/or sold after importation into the United States by Opticon and/or its authorized agents. *See* Exhibits 23, 27.

118. Upon information and belief, most or all of the Accused Products are manufactured either by OPTO Electronics Co., Ltd.'s subsidiary Hokkaido at manufacturing facilities in Japan or on behalf of Opticon at one or more contract manufacturing facilities in China. *See* Exhibit 23.

119. Exhibit 27 contains photographs of an Opticon L-50X, which includes a MDI-3100 scan engine, including various components and parts thereof, purchased from a retailer in the United States. These photographs show, *inter alia*, that the L-50X indicates that it was "Made in China." The packaging and the L-50X itself also indicate as follows: "Made in China." Specifically, Honeywell's counsel caused an Opticon L-50X to be purchased on May 13, 2019 from Barcodes, Inc., based in Chicago, Illinois. *See* Exhibit 26.

VIII. HARMONIZED TARIFF SCHEDULE NUMBERS

120. On information and belief, the Accused Products have been imported into the United States under at least the following Harmonized Tariff Schedule numbers: 8471605000 and 8471900000.

IX. RELATED LITIGATION

121. Concurrent with the instant complaint, Honeywell will file a complaint in the U.S. District Court for the District of Delaware alleging infringement of the Asserted Patents against Opticon.

122. U.S. Patent No. 7,568,628, which issued from the parent application of the applications that resulted in the 970 and 985 patents, was the subject of an *Inter Partes* Review Petition filed on September 20, 2013 in *Fujian Newland Computer Co., Ltd. v. Hand Held*

Products, Inc., IPR2013-00595 (PTAB). The PTAB instituted review of claims 1, 18, 35, 36, 39, 44, and 46 on February 28, 2014. And the PTAB issued its Final Written Decision on February 18, 2015 affirming the validity of all challenged claims.

123. On May 23, 2017, Honeywell International, Inc., Hand Held, and Metrologic filed a complaint with the ITC asserting infringement of the 923 patent, the 206 patent, and four other patents against The Code Corporation ("Code") and its subsidiary Cortex Ltd. The ITC instituted Investigation No. 337-TA-1061 on June 21, 2017 based on that complaint.

124. On January 17, 2018, the Commission entered a Consent Order against Code, barring importation or the sale after importation, *inter alia*, of Code's products that infringe claims 10, 19-21, 24-28, and 31 of the 923 patent. That Consent Order remains effective today.

125. The Commission terminated the 1061 Investigation as to the remaining asserted claims of the 923 patent and the asserted claims of the 206 patent on March 22, 2018 based on a confidential settlement agreement between Honeywell and Code.

126. Other than as described above, the alleged unfair methods of competition and unfair acts, or the subject matter thereof, are not and have not been the subject of any court or agency litigation.

X. DOMESTIC INDUSTRY

127. An industry as required by Section 337(a)(2) and as defined by Section 337(a)(3) exists in the United States. Honeywell offers several styles and lines of its scanner products, including the products sold under the Granit and Xenon trade names, that practice one or more of the Asserted Patents, including the Xenon 1900g, Xenon 1902g, Xenon 1900h, Xenon 1902h, Granit 1910i, Granit 1911i, Granit 1920i, Vuquest 3320g, the N5600-series scan engines, the N6600-series engines the CK75, Dolphin 60s, Dolphin 75e, Dolphin 99, certain Dolphin 6110

products, Dolphin 7800, Dolphin ck65, Dolphin cn80, Dolphin ct40 products, Dolphin ct50, Dolphin ct60, and the Captuvo sleds (collectively, "Honeywell Barcode Scanners"), and has spent millions of dollars in the United States to create, test, and support these models for use by U.S. consumers. Thus, Honeywell's activities as they relate to the Honeywell Barcode Scanners support a domestic industry relating to barcode scanning products that practice the Asserted Patents.

A. Honeywell's Practice of the Asserted Patents

128. As stated above, for purposes of this complaint, Honeywell submits its Xenon 1902g as representative of Honeywell's barcode scanners that practice the Asserted Patents. The following table provides an exemplary summary of the Asserted Patents being practiced by Honeywell's products:

U.S. Patent No.	Honeywell Products
9,465,970	At least Xenon 1900g, Xenon 1902g, Xenon 1900h, Xenon 1902h, Granit 1910i, Granit 1911i, Granit 1920i, Vuquest 3320g, the N5600-series scan engines, the N6600-series engines the CK75, Dolphin 60s, Dolphin 75e, Dolphin 99, certain Dolphin 6110 products, Dolphin 7800, Dolphin ck65, Dolphin cn80, Dolphin ct40 products, Dolphin ct50, Dolphin ct60, and the Captuvo sleds
8,978,985	At least Xenon 1900g, Xenon 1902g, Xenon 1900h, Xenon 1902h, Granit 1910i, Granit 1911i, Granit 1920i, Vuquest 3320g, the N5600-series scan engines, the N6600-series engines the CK75, Dolphin 60s, Dolphin 75e, Dolphin 99, certain Dolphin 6110 products, Dolphin 7800, Dolphin ck65, Dolphin cn80, Dolphin ct40 products, Dolphin ct50, Dolphin ct60, and the Captuvo sleds
7,148,923	At least Xenon 1900g, Xenon 1902g, Xenon 1900h, Xenon 1902h, Granit 1910i, Granit 1911i, Granit 1920i, Vuquest 3320g, the N5600-series scan engines, the N6600-series engines the CK75, Dolphin 60s, Dolphin 75e, Dolphin 99, certain Dolphin 6110

U.S. Patent No.	Honeywell Products
	products, Dolphin 7800, Dolphin ck65, Dolphin cn80, Dolphin ct40 products, Dolphin ct50, Dolphin ct60, and the Captuvo sleds
7,527,206	At least Xenon 1900g, Xenon 1902g, Xenon 1900h, Xenon 1902h, Granit 1910i, Granit 1911i, Granit 1920i, Vuquest 3320g, the N5600-series scan engines, the N6600-series engines the CK75, Dolphin 60s, Dolphin 75e, Dolphin 99, certain Dolphin 6110 products, Dolphin 7800, Dolphin ck65, Dolphin cn80, Dolphin ct40 products, Dolphin ct50, Dolphin ct60, and the Captuvo sleds
9,659,199	At least Xenon 1900g, Xenon 1902g, Xenon 1900h, Xenon 1902h, Granit 1910i, Granit 1911i, Granit 1920i, Vuquest 3320g, the N5600-series scan engines, the N6600-series engines the CK75, Dolphin 60s, Dolphin 75e, Dolphin 99, certain Dolphin 6110 products, Dolphin 7800, Dolphin ck65, Dolphin cn80, Dolphin ct40 products, Dolphin ct50, Dolphin ct60, and the Captuvo sleds
7,159,783	At least Xenon 1900g, Xenon 1902g, Xenon 1900h, Xenon 1902h, Granit 1910i, Granit 1911i, Granit 1920i, Vuquest 3320g, the N5600-series scan engines, the N6600-series engines the CK75, Dolphin 60s, Dolphin 75e, Dolphin 99, certain Dolphin 6110 products, Dolphin 7800, Dolphin ck65, Dolphin cn80, Dolphin ct40 products, Dolphin ct50, Dolphin ct60, and the Captuvo sleds
8,794,520	At least Xenon 1900g, Xenon 1902g, Xenon 1900h, Xenon 1902h, Granit 1910i, Granit 1911i, Granit 1920i, Vuquest 3320g, the N5600-series scan engines, the N6600-series engines the CK75, Dolphin 60s, Dolphin 75e, Dolphin 99, certain Dolphin 6110 products, Dolphin 7800, Dolphin ck65, Dolphin cn80, Dolphin ct40 products, Dolphin ct50, Dolphin ct60, and the Captuvo sleds

129. In addition, Honeywell is actively designing barcode scanning devices in the United States that will use technology claimed in the Asserted Patents and thus, these new products also may practice the Asserted Patents.

130. Information regarding Honeywell's Xenon 1902g, including an operation manual, screenshots, and photographs, are included in Exhibits 35-36.

131. Exhibit 28 contains a claim chart showing that Honeywell's Xenon 1902g practices claim 1 of the 970 Patent.

132. Exhibit 29 contains a claim chart showing that Honeywell's Xenon 1902g practices claim 1 of the 985 Patent.

133. Exhibit 30 contains a claim chart showing that Honeywell's Xenon 1902g practices claim 29 of the 923 Patent.

134. Exhibit 31 contains a claim chart showing that Honeywell's Xenon 1902g practices claim 20 of the 206 Patent.

135. Exhibit 32 contains a claim chart showing that Honeywell's Xenon 1902g practices claim 1 of the 199 Patent.

136. Exhibit 33 contains a claim chart showing that Honeywell's Xenon 1902g practices claim 20 of the 783 Patent.

137. Exhibit 34 contains a claim chart showing that Honeywell's Xenon 1902g practices claim 18 of the 520 Patent.

B. Honeywell's Investments in the United States Relating to Products That Practice the Asserted Patents

138. Honeywell has made, and continues to make, substantial investments in the United States to create and support the products that practice the Asserted Patents.

139. In addition to the above, in 2011 Honeywell designed and released its Xenon line of barcode scanners, some of which compete with the infringing Opticon L-50X.

140. Honeywell's Xenon line of barcode scanners revolutionized the market, ushering a new area of barcode scanning technology. Certain Xenon scanners are specifically designed for

healthcare facilities, industrial settings, and retail use, respectively. These scanners are able to withstand up to 50 drops to concrete from distances as high as 6 feet and have IP41 environmental sealing, allowing them to be cleaned and disinfected for healthcare facilities. Because of their industry leading technologies, the Xenon scanners have extended field depths and can read barcodes that have been damaged, are high-density, are translucent, or are in color.

141. The Xenon products were designed in the United States, primarily in New York and New Jersey. And the Xenon products are supported, maintained, and repaired in the United States, primarily in North Carolina and South Carolina.

142. Honeywell continues to update and improve its Xenon products, and continues to develop and launch newer versions.

143. Honeywell has expended considerable resources on plant and equipment, labor and capital, and engineering and research and development to support the Honeywell Scanners in the United States. These expenditures continue as Honeywell further improves the Honeywell Barcode Scanners and also seeks to develop new barcode scanners and related technologies. A discussion of both current and future representative expenditures is set forth below.

1. Significant Investment in Plant and Equipment

144. Honeywell has spent, and continues to spend, significant sums on its domestic facilities supporting the products that practice the Asserted Patents. For example, the research and development efforts for each of the Honeywell Barcode Scanners took place at least in Honeywell's New York, New Jersey, and South Carolina facilities, in which Honeywell has made, and continues to make, extensive investments. *See* Confidential Exhibit 38.

2. Significant Employment of Labor and Capital

145. Honeywell has engaged in, and continues to engage in, significant employment of labor and capital in the United States. As of May 2019 Honeywell had approximately 43,000 U.S.-based employees. Honeywell employs about 1100 people in the United States in its Productivity Products business group, which includes the scan engines, scanners, and mobility products identified above. Honeywell employs many U.S.-based employees working in research and development or in ongoing product maintenance that supports the Honeywell Barcode Scanners. *See* Confidential Exhibit 38.

3. Substantial Investments in Engineering and Research and Development

146. Honeywell has made, and continues to make, substantial investment in engineering and research and development activities that support the products that practice the Asserted Patents.

147. For example, just since 2015, Honeywell has spent millions of dollars in the United States on the research and development of the Honeywell barcode scanners. These expenditures include, but are not limited to, direct technical program costs and costs for building prototypes and testing of these barcode scanning devices. *See* Confidential Exhibit 38.

4. Other Expenditures

148. Honeywell supports its products, including the Honeywell Barcode Scanners, with substantial customer and consumer service, warranty, and repair teams. These teams include personnel located in North Carolina and South Carolina that handle repairs and a team of field support specialists that train distributors, retailers, and customers how to use the products. At its Fort Mill, SC facility, Honeywell built and maintains a testing laboratory with various equipment used to manufacture, test, and analyze various prototypes and products. Honeywell also invests

substantial sums in its logistics, warehousing, and distribution of its products within the United States. Honeywell relies heavily on the domestic services of domestic third-party logistics providers. Honeywell also has a significant OEM business, selling software and scanner engines to third parties that manufacture products in the United States. *See* Confidential Exhibit 38.

XI. REQUEST FOR RELIEF

149. Complainants request that the U.S. International Trade Commission:

a. Institute an immediate investigation, pursuant to Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, with respect to violations of Section 337 based upon the sale for importation into the United States, the importation into the United States, and/or the sale within the United States after importation of Respondents' barcode scanners, scan engines, products containing the same, and components thereof that infringe one or more claims of the Asserted Patents;

b. Determine that there has been a violation of Section 337 by each Respondent;

c. Issue a permanent limited exclusion order, pursuant to 19 U.S.C. § 1337(d), prohibiting entry into the United States all of Respondents' barcode scanners, scan engines, products containing the same, and components thereof that infringe one or more claims of the Asserted Patents;

d. Issue permanent cease and desist orders, pursuant to 19 U.S.C. § 1337(f), prohibiting Respondents, or their parents, subsidiaries, or other affiliates, from importing, admitting or withdrawing from a foreign trade zone, marketing, advertising, demonstrating, warehousing inventory, distributing, offering for sale, selling, licensing, repairing, programming, or updating

barcode scanners, scan engines, products containing the same, and components thereof that infringe one or more claims of the Asserted Patents;

e. Require appropriate bond be posted, pursuant to 19 U.S.C. § 1337(j), with Customs and Border Protection (CBP) for entry of any Accused Product or component thereof during the Presidential review period;

f. Require an appropriate bond be posted, pursuant to 19 U.S.C. § 1337(j), with the Commission for each and every proscribed activity pursuant to the Cease and Desist Order during the Presidential review period; and

g. Grant such other and further relief as the Commission deems just and proper based on the facts determined by the investigation and the authority of the Commission.

Dated: May 31, 2019

Respectfully submitted,

M. Scott Stevens
ALSTON & BIRD LLP
950 F Street NW
Washington, DC 20004
Telephone: (202) 239-3025
Facsimile: (704) 654-4825

S. Benjamin Pleune
Stephen R. Lareau
Adam J. Doane
Nicholas C. Marais
ALSTON & BIRD LLP
101 South Tryon Street
Suite 4000
Charlotte, NC 28280
Telephone: (704) 444-1098
Facsimile: (704) 444-1698

Patrick J. Flinn
ALSTON & BIRD LLP
One Atlantic Center
1201 West Peachtree Street
Suite 4900
Atlanta, GA 30309
Telephone: (404) 881-9720
Facsimile: (404) 253-8370

Counsel for Complainants
Honeywell International, Inc.,
Hand Held Products, Inc., and
Metrologic Instruments, Inc.

VERIFICATION OF COMPLAINT

I, Jeremy Whitley, declare under penalty of perjury under the laws of the United States of America, and in accordance with 19 C.F.R. §§ 210.4 and 210.12(a) the following is true and correct:

1. I am the Chief Intellectual Property Counsel at Honeywell Safety & Productivity Solutions, and I am duly authorized to verify this complaint on behalf of complainants;

2. I have read the complaint and am aware of its contents;

3. The complaint is not being presented for any improper purpose, such as to harass or to cause unnecessary delay or needless increase in the cost of the investigation or related proceeding;

4. To the best of my knowledge, information and belief founded upon reasonable inquiry, the claims and legal contentions of this complaint are warranted by existing law or a nonfrivolous argument for the extension, modification, or reversal of existing law or the establishment of new law; and

5. To the best of my knowledge, information and belief founded upon reasonable inquiry, the allegations and other factual contentions in the complaint have evidentiary support or, if specifically so identified, are likely to have evidentiary support after a reasonable opportunity for further investigation or discovery.

Executed on May 30, 2019.

Jeremy Whitley

Exhibit 2

UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

In the Matter of **CERTAIN BARCODE SCANNERS, SCAN ENGINES, PRODUCTS CONTAINING THE SAME, AND COMPONENTS THEREOF**	**Inv. No. 337-TA-1165**

ORDER NO. 11: INITIAL DETERMINATION GRANTING COMPLAINANTS' UNOPPOSED MOTION TO PARTIALLY TERMINATE THE INVESTIGATION AS TO CERTAIN CLAIMS OF THE ASSERTED PATENTS [MOTION DOCKET NO. 1165-004]

(October 25, 2019)

On October 21, 2019, pursuant to Commission Rule 210.21(a), Complainants Honeywell International, Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. (collectively, "Honeywell" or "Complainants") filed an unopposed motion for partial termination of this Investigation ("Motion") with respect to the following asserted claims: (i) claims 5, 10, 16, 18, 22, 23, 25-31, 34-42, 47, 52, 58, 60, and 61 of U.S. Patent No. 9,465,970 ("the '970 patent"); (ii) claims 5, 12, 13, 15-21, and 24 of U.S. Patent No. 8,978,985 ("the '985 patent"); (iii) claims 1-6, 8, 10, and 19-28 of U.S. Patent No. 7,148,923 ("the '923 patent"); (iv) claims 2, 3, 19, and 28 of U.S. Patent No. 7,527,206 ("the '206 patent"); (v) claims 2, 7, 9, and 14-20 of U.S. Patent No. 9,659,199 ("the '199 patent"); and (vi) claims 10-13, 15, and 17-19 of U.S. Patent No. 7,159,783 ("the '783 patent").[1] (Motion Docket No. 1165-011 (Oct. 21, 2019); Mot. at 1.).

In accordance with Ground Rule 2.2, Honeywell certifies that Respondents Opticon, Inc.,

[1] Honeywell also requests that the Procedural Schedule (Order No. 5) be suspended with respect to the terminated claims while the Commission reviews this Initial Determination ("ID"), which is unnecessary. (*Id.*). That all deadlines are suspended with regard to the terminated claims is implicit in granting Honeywell's Motion.

Opticon Sensors Europe B.V., OPTO Electronics Co., Ltd., and Hokkaido Electronic Industry Co., Ltd. (collectively, "Opticon" or "Respondents," and with Complainants, the "Parties") do not oppose Honeywell's Motion. (*Id.* at 4.).

Commission Rules permit a motion to terminate part of an investigation based upon withdrawal of certain allegations contained within the Complaint, before issuance of the Initial Determination on Violation of Section 337. 19 C.F.R. § 210.21(a)(1). An administrative law judge may grant said motion upon such terms and conditions as she deems proper. *Id.* The Commission has held that "in the absence of extraordinary circumstances, termination of an investigation will be readily granted to a complainant during the prehearing stage of an investigation." *Certain Ultrafiltration Membrane Sys., and Components Thereof, Including Ultrafiltration Membranes*, Inv. No. 337-TA-107, Comm'n Action and Order at 2 (U.S.I.T.C. Mar. 11, 1982); *see also Certain Television Sets, Television Receivers, Television Tuners, and Components Thereof*, Inv. No. 337-TA-910, Order No. 50 at 2 (U.S.I.T.C. Nov. 12, 2014). Public policy supports termination in order to conserve public and private resources. *Certain Universal Serial Bus ("USB") Portable Storage Devices, Including USB Flash Drives and Components Thereof*, Inv. No. 337-TA-788, Order No. 16 at 2 (U.S.I.T.C. Mar. 21, 2012).

Here, the Parties have presented no extraordinary circumstances that would justify denying Honeywell's Motion seeking to terminate claims 5, 10, 16, 18, 22, 23, 25-31, 34-42, 47, 52, 58, 60, and 61 of the '970 patent; claims 5, 12, 13, 15-21, and 24 of the '985 patent; claims 1-6, 8, 10, and 19-28 of the '923 patent; claims 2, 3, 19, and 28 of the '206 patent; claims 2, 7, 9, and 14-20 of the '199 patent; and claims 10-13, 15, and 17-19 of the '783 patent from this Investigation. Moreover, Honeywell stated in accordance with 19 C.F.R. § 210.21(a)(1) that "there are no agreements, written or oral, express or implied between the parties concerning the

subject matter of the Investigation." (Mot. at 3.).

Therefore, it is my Initial Determination that the Investigation be partially terminated with respect to the aforementioned claims, and that Motion Docket No. 1165-011 be *granted.*

This Initial Determination is hereby certified to the Commission. Pursuant to 19 C.F.R. § 210.42(h), this Initial Determination shall become the determination of the Commission unless a party files a petition for review of the Initial Determination pursuant to 19 C.F.R. § 210.43(a), or the Commission orders on its own motion a review of the Initial Determination or certain issues herein pursuant to 19 C.F.R. § 210.44.

SO ORDERED.

MaryJoan McNamara
Administrative Law Judge

CERTAIN BARCODE SCANNERS, SCAN ENGINES, PRODUCTS CONTAINING THE SAME, AND COMPONENTS THEREOF

Inv. No. 337-TA-1165

PUBLIC CERTIFICATE OF SERVICE

I, Lisa R. Barton, hereby certify that the attached **INITIAL DETERMINATION** has been served by hand upon the following parties as indicated, on **October 25, 2019**.

Lisa R. Barton, Secretary
U.S. International Trade Commission
500 E Street, SW, Room 112
Washington, D.C. 20436

On Behalf of Complainants Honeywell International, Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc.:

M. Scott Stevens, Esq.
ALSTON & BIRD LLP
950 F Street, NW
Washington, D.C. 20004

☐ Via Hand Delivery
☑ Via Express Delivery
☐ Via First Class Mail
☐ Other:_____________

On Behalf of Respondents Opticon, Inc., Opticon Sensors Europe B.V., OPTO Electronics Co., Ltd., and Hokkaido Electronic Industry Co., Ltd.:

S. Alex Lasher, Esq.
QUINN EMANUEL URQUHART & SULLIVAN, LLP
1300 I Street, NW, Suite 900
Washington, D.C. 20005

☐ Via Hand Delivery
☑ Via Express Delivery
☐ Via First Class Mail
☐ Other:_____________

Exhibit 3

Public Version

UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

In the Matter of **CERTAIN BARCODE SCANNERS, SCAN ENGINES, PRODUCTS CONTAINING THE SAME, AND COMPONENTS THEREOF**	**Inv. No. 337-TA-1165**

ORDER NO. 13: **ORDER WITH RESPECT TO: THE SCOPE OF THIS INVESTIGATION, *MARKMAN* CLAIM CONSTRUCTION, *MARKMAN* HEARING, DISCOVERY, AND OTHER SCHEDULING ISSUES**

(November 8, 2019)

On November 7, 2019, I held a telephone management conference ("Teleconference") pursuant to Ground Rule 2.5, to discuss certain discovery-related issues that were raised in an October 25, 2019 letter from Complainants Honeywell International, Inc. Hand Held Products, Inc. and Metrologic Instruments, Inc. (collectively, "Honeywell") and addressed in a responsive October 29, 2019 letter from Respondents Opticon, Inc., Opticon Sensors, Europe B.V., OPTO Electronics Co., Ltd., and Hokkaido Electronic Industry Co., Ltd. (collectively, "Opticon," and with Honeywell, "the Parties").

The Teleconference participants discussed, *inter alia*, Honeywell's request for leave to file a motion to compel additional answers to its Interrogatory Nos. 54-56 and 59 that pertain to unresolved issues with respect to Accused Products; discovery more generally; the unwieldiness of the Investigation in terms of numbers of Asserted Patents and Asserted Claims; the failure of the Notice of Prior Art to constitute proper notice because of the hundreds of references cited;

Public Version

and the numbers of claim terms identified for *Markman* construction. Based upon the issues discussed during the Teleconference, I am issuing the following Orders:

1. I am reserving the full scope of Honeywell's Motion to Compel until the Parties have complied with other parts of this Order. However, Opticon is to provide Honeywell with any additional facts and information that pertain to Accused Products as it has in its possession that have not already been provided to Honeywell while Honeywell should identify as many Accused Products it contends infringes for which it has evidence once Honeywell identifies that Asserted Patents that will remain in this Investigation.

2. Honeywell may proceed in this Investigation with no more than four (4) Asserted Patents. Honeywell must identify the Accused Patents it is retaining in this Investigation and those it is dropping in a filing on EDIS and in a copy it should submit to McNamara337@usitc.gov, by ***no later than 12 o'clock noon on November 15, 2019.***

3. Honeywell may proceed in this Investigation with no more than a total of 12-15 Asserted Claims across the Asserted Patents Honeywell chooses to retain. Honeywell must identify those Asserted Claims it is retaining and file a notice on EDIS, and submit a copy to McNamara337@usitc.gov, by ***no later than 12 o'clock noon on November 15, 2019.***

4. Opticon must revise its Notice of Prior Art to identify no more than four (4) prior art references, whether alone or in combination, for each Asserted Patent Honeywell retains. The prior art references Opticon identifies should encompass all its anticipation and obvious contentions and should be taken from its previously filed Notice of Prior Art. Opticon should file its Revised Notice of Prior Art on EDIS, and submit a copy to McNamara337@usitc.gov, by ***no later than November 20, 2019.***

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5. The Parties may proceed with no more than 16-20 disputed claim terms for *Markman* construction although a fewer number is preferable. For any remaining disputed claim terms, Opticon must identify and name any other court decisions in which the remaining disputed claim terms have been construed.

6. The Parties should file a Revised Joint Claim Construction Chart on EDIS and submit a copy to McNamara337@usitc.gov. The Revised Joint Claim Construction Chart should identify all remaining disputed claim terms. For any remaining disputed claim terms for which Honeywell argued for "plain and ordinary meaning," it must provide a plain and ordinary meaning consistent with my Ground Rules. Similarly, Opticon must provide in the Joint Claim Construction Chart an explanation for disputed claim terms it describes as indefinite. The Revised Joint Claim Construction Chart must be file ***no later than November 20, 2019.***

7. The initial expert reports ***previously due on November 25, 2019*** will be due ***on December 2, 2019.*** Two (2) copies of each should be submitted to Chambers, together with thumb drives. The thumb drives should be contained in an envelope from each party, which identifies the Investigation, the content of the thumb drive, the date submitted, and the name of the law firm.

8. A *Markman* hearing will be held ***on Monday, December 2, 2019*** in Courtroom C. No more than 10 disputed claim terms may be argued during the *Markman* hearing, with two (2) held in reserve in case there is time to discuss them. The Parties should file the list of the disputed claim terms to be argued during the *Markman* hearing on EDIS, and submit a copy of the same to McNamara337@usitc.gov, ***by November 26, 2019.***

The *Markman* hearing will start at 9:30 a.m. and end no later than 5:30 p.m. The Parties may decide if they wish to provide a joint or separate technology tutorials. The order in which

they present is in the discretion of the Parties. Experts may not present disputed claim terms. The Parties should rely on the intrinsic texts of the patents and use expert argument/opinion as a last resort.

The *Markman* reply briefs previously scheduled for November 8, 2019 are postponed. Whether *Markman* reply briefs will be permitted at all will be discussed during the *Markman* hearing on December 2, 2019. If allowed, they will be limited to narrow disputes and not re-argument.

9. The Parties must meet and confer and attempt to agree upon a Stipulation of Representative Accused Products that reflect the two "buckets," [redacted], that Honeywell's counsel identified, ***by no later than November 21, 2019***. Honeywell should identify as many of the Accused Products that it believes infringe the remaining Asserted Patents, based on evidence it has received to date, and provide Opticon with more detailed contentions. Similarly, Opticon has the obligation to supplement its Interrogatory answers with more complete information that will help lead to a Stipulation with respect to Accused Products. This issue will be revisited at the end of the *Markman* hearing ***on December 2, 2019*** with a status report to be given by each party.

10. Opticon has agreed to have translated in its entirety from the Japanese the two-page, redacted Excel spread sheet that has been described as a listing of Honeywell patents that was kept in the ordinary course of business by one of Opticon's employees, Mr. Yoshiaki Kohmo (as referenced in Opticon's October 29, 2019 letter, at p. 2.). If, after translation, it is apparent to Opticon's counsel that there is no new information not previously disclosed to Honeywell with respect to the Asserted Patents that remain in this Investigation, or with respect to Honeywell patents that share a specification with the Asserted Patents, he shall file an

unequivocal Declaration, under oath and notarized, that such is the case. If, however, after translation of the two-page, redacted Excel spread sheet, there is additional information about the Asserted Patents that remain in this Investigation, or that share specifications with the remaining Asserted Patents in this Investigation, that information shall be disclosed to Honeywell. This shall be accomplished by ***no later than November 22, 2019***.

Honeywell is not entitled to any information in the two-page, redacted Excel spread sheet that does not reference or relate to the Asserted Patents or patents that share a specification with the Asserted Patents. Honeywell's counsel should confer with Opticon's issue to identify as narrowly as possible, those Honeywell patents that may be related to the Asserted Patents. This issue will be revisited after the *Markman* hearing ***on December 2, 2019.***

11. Honeywell's counsel stated during the Teleconference that a Rule 30(b)(6) deposition of one of Opticon's employees has been scheduled. If that individual reveals that Mr. Kohmo kept other information with respect to Honeywell's Asserted Patents, not otherwise privileged, or that there are other documents, including e-mails, regarding the same, that are not otherwise privileged, Opticon will search for those documents and produce them without delay. If Honeywell finds there are other documents that suggest there is other information, not otherwise privileged, that either Mr. Kohmo or others kept prior to 2017 with respect to the Asserted Patents and Opticon refuses to produce such information to Honeywell, Honeywell's counsel should notify Chambers by a filing on EDIS, which should also be submitted to McNamara337@usitc.gov, as soon as it becomes apparent there is an impasse.

12. Hard copies of all documents submitted should also be sent to Chambers in addition to any other forms of submission described above.

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Within fourteen (14) days of the date of this document, the Parties shall submit jointly to the Office of Administrative Law Judges, both by hard copy and to McNamara337@usitc.gov, a joint statement whether they seek any portion of this document deleted from the public version. The Parties' submission shall be made by hard copy and must include a copy of this ID with yellow highlighting, with or without red brackets, indicating any portion asserted to contain CBI to be deleted from the public version. The submission shall also include a chart that: (I) contains the page number of each proposed redaction; and (ii) states (next to each page number) every sentence or phrase, listed separately, that the party proposes be redacted; and (iii) for each such sentence or phrase that the party proposes be redacted, a citation to case law with an explanation as to why each proposed redaction constitutes CBI consistent with case law. Any proposed redaction that is not explained may not be redacted after a review. The Parties' submission concerning the public version of this document need not be filed with the Commission Secretary.

SO ORDERED.

MaryJoan McNamara
Administrative Law Judge

CERTAIN BARCODE SCANNERS, SCAN ENGINES, PRODUCTS CONTAINING THE SAME, AND COMPONENTS THEREOF | **Inv. No. 337-TA-1165**

PUBLIC CERTIFICATE OF SERVICE

I, Lisa R. Barton, hereby certify that the attached **ORDER** has been served by hand upon the following parties as indicated, on **December 12, 2019**.

Lisa R. Barton, Secretary
U.S. International Trade Commission
500 E Street, SW, Room 112
Washington, D.C. 20436

On Behalf of Complainants Honeywell International, Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc.:

M. Scott Stevens, Esq.
ALSTON & BIRD LLP
950 F Street, NW
Washington, D.C. 20004

☐ Via Hand Delivery
☐ Via Express Delivery
☒ Via First Class Mail
☐ Other:____________

On Behalf of Respondents Opticon, Inc., Opticon Sensors Europe B.V., OPTO Electronics Co., Ltd., and Hokkaido Electronic Industry Co., Ltd.:

S. Alex Lasher, Esq.
QUINN EMANUEL URQUHART & SULLIVAN, LLP
1300 I Street, NW, Suite 900
Washington, D.C. 20005

☐ Via Hand Delivery
☐ Via Express Delivery
☒ Via First Class Mail
☐ Other:____________

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, DC

Before The Honorable MaryJoan McNamara
Administrative Law Judge

In the Matter of **CERTAIN BARCODE SCANNERS, SCAN ENGINES, PRODUCTS CONTAINING THE SAME, AND COMPONENTS THEREOF**	**Investigation No. 337-TA-1165**

COMPLAINANTS' RESPONSE TO ORDER NO. 13

Complainants Honeywell International, Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. (collectively, "Honeywell") provide the following response to Order No. 13. Pursuant to paragraphs 2 and 3 of Order No. 13, Honeywell identifies the following retained patents and claims in this Investigation.

Asserted Patents:	Asserted Claims:
9,465,970	**1**, 13, 14, 21, **85**
7,148,923	**29**, 31
7,527,206	**11**, 12, **20**, 23
9,659,199	**1**, **8**, 11, 13

Dated: November 15, 2019

Respectfully submitted,

/s/ M. Scott Stevens
M. Scott Stevens
ALSTON & BIRD LLP
950 F Street NW

Washington, DC 20004
Telephone: (202) 239-3025
Facsimile: (704) 654-4825

S. Benjamin Pleune
Stephen R. Lareau
Adam J. Doane
Nicholas C. Marais
Lauren N. Bond
ALSTON & BIRD LLP
101 South Tryon Street
Suite 4000
Charlotte, NC 28280
Telephone: (704) 444-1098
Facsimile: (704) 444-1698

Yuri Mikulka
Alston & Bird LLP
333 South Hope Street, 16th Floor
Los Angeles, CA 90071
Telephone: (213) 576-1026

Counsel for Complainants
Honeywell International, Inc.,
Hand Held Products, Inc., and
Metrologic Instruments, Inc.

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this day, a true and correct copy of the foregoing document was served by the indicated means to the person(s) at the addresses below:

The Honorable Lisa R. Barton Secretary to the Commission **U.S. International Trade Commission** 500 E Street, S.W., Room 112 Washington, DC 20436	Via Electronic Filing (EDIS)
The Honorable MaryJoan McNamara Administrative Law Judge **U.S. International Trade Commission** 500 E Street, SW Washington, D.C. 20436 Jae B. Lee Attorney Advisor **U.S. International Trade Commission** 500 E Street, S.W. Washington, DC 20436	Via Hand Delivery (2 copies) to be delivered by the next Business Day Via Electronic Mail to: McNamara337@usitc.gov Jae.Lee@usitc.gov
S. Alex Lasher Jeffrey S. Gerchick Jared W. Newton K. Kevin Chu QUINN EMANUEL URQUHART & SULLIVAN, LLP 1300 I Street, NW, Suite 900 Washington, D.C. 20005 Tel.: (202) 538-8000 Richard W. Erwine Kevin Jang QUINN EMANUEL URQUHART & SULLIVAN, LLP 51 Madison Ave. New York, NY 10010 Tel.: (212) 849-7000 Steven Cherny QUINN EMANUEL URQUHART & SULLIVAN, LLP 111 Huntington Ave, Suite 520 Boston, MA 02199 Tel.: (617) 712-7100	Via Electronic Mail to: optoitc@quinnemanuel.com mick@minaminolaw.com

Ryan S. Goldstein York M. Faulkner QUINN EMANUEL URQUHART & SULLIVAN, LLP Hibiya U-1 Bldg., 25F 1-1-7, Uchisaiwai-cho Chiyoda-ku, Tokyo, 100-0011 Japan Tel.: +81 3 5510 1711 Koichiro Minamino MINAMINO LAW OFFICE, PLLC 1300 I Street, N.W. Suite 900 Washington, DC 20005 Tel.: (202) 777-3638 *Counsel for Respondents Opticon, Inc., Opticon Sensors Europe B.V., OPTO Electronics Co., Ltd., and Hokkaido Electronic Industry Co., Ltd.*	

Date: November 15, 2019

/s/ M. Scott Stevens
M. Scott Stevens

Exhibit 4

INFRINGEMENT CLAIM CHART – U.S. Patent No. 7,159,783 – Exhibit F-1

[redacted]

Claim Chart Showing Infringement of U.S. Patent No. 7,159,783 by the Accused Devices[1]

Opticon devices with a script-interpreter program (the "Accused Devices") directly and/or indirectly infringe the asserted claims of U.S. Patent No. 7,159,783 (the "783 Patent"). For example, Opticon's 2D scanners and scan engines, including H-28, H-29, OPN-3002n, OPN-3002i, OPN-3102i, PX-20, M-10, M-11, NLV-3101, NLV-5201, L-22X, L-46X, L-50X, L-51X, OPI-3601, PX-36, MDI-3100, MDI-4100, MDI-4050, MDI-4150, FDI-4100, MDI-3000, MDI-4000, MDI-5010, MDI-3200, and the M-10M infringe the 783 Patent as described below. The Opticon L-46X handheld scanner ("Opticon L-46X"), which includes the MDI-4100 scan engine ("Opticon MDI-4100"), and which was deployed with R-40 software build, and which is compatible with Opticon's Data Edit tool, is a representative Accused Device and the functionality detailed in the chart below is representative of the functionality of the Accused Devices, unless otherwise noted. Honeywell contends each of the following limitations is met literally, and, to the extent a limitation is not met literally, it is met under the Doctrine of Equivalents.

[redacted]	[redacted]
[redacted]	
[redacted]	[redacted]

[1] This claim chart is based on the information currently available to Honeywell. Honeywell reserves all rights to update and elaborate its infringement positions, including in light of any claim construction positions provided by Respondents and/or any claim construction Order received from the Administrative Law Judge.

INFRINGEMENT CLAIM CHART – U.S. Patent No. 7,159,783 – Exhibit F-3

[redacted]

Claim Chart Showing Infringement of U.S. Patent No. 7,159,783 by the 1D Products[1]

Opticon 1D Products directly and/or indirectly infringe the asserted claims of U.S. Patent No. 7,159,783 (the "783 Patent"). The 1D Products include the OPN-2001, OPN-2004, OPN-2006, OPN-4000i, OPN-4000n, NFT-2200, NFT-2100, NFT-8175, NLB-1000, NLV-1001, NLV-4001, RLB-1000, C-37, C-41S, L-46R, L-50C, OPC-3301i, OPI-3301i, OPL-6845S, OPR-2001Z, OPR-2001, OPR-3201Z, RS-2006/OPN2006, MDC-200, MDL-1000, MDL-1500, MDL-2001, OPR-3004, OPR-3101, F-100, F-70, C-40, C-41, MDL-2101 (collectively the "1D Products"). The 1D Products infringe the 783 Patent at least because they have a script-interpreter program as claimed in the 783 Patent. Additionally, the Opticon OPN-4000i companion scanner ("Opticon OPN-4000i") is representative of the 1D Products at least because the other 1D Opticon products function in the same or substantially similar manner to the Opticon OPN-4000i. Honeywell contends each of the following limitations is met literally, and, to the extent a limitation is not met literally, it is met under the Doctrine of Equivalents.

[redacted]	[redacted]
[redacted]	
[redacted]	[redacted]

[1] This claim chart is based on the information currently available to Honeywell. Honeywell reserves all rights to update and elaborate its infringement positions, including in light of any claim construction positions provided by Respondents and/or any claim construction Order received from the Administrative Law Judge.

LEGAL02/39316651v2

Exhibit 5

INTERNATIONAL STANDARD

ISO/IEC 15415

Second edition
2011-12-15

Reviewed and confirmed in 2018

Information technology — Automatic identification and data capture techniques — Bar code symbol print quality test specification — Two-dimensional symbols

Technologies de l'information — Techniques automatiques d'identification et de capture des données — Spécification de test de qualité d'impression des symboles de code à barres — Symboles bidimensionnels

Reference number
ISO/IEC 15415:2011(E)

Contents

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15415 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

This second edition cancels and replaces the first edition (ISO/IEC 15415:2004), which has been technically revised. It also incorporates the Technical Corrigendum ISO/IEC 15415:2004/Cor.1:2008.

Introduction

The technology of bar coding is based on the recognition of patterns encoded, in bars and spaces or in a matrix of modules of defined dimensions, according to rules defining the translation of characters into such patterns, known as the symbology specification. Symbology specifications may be categorised into those for linear symbols, on the one hand, and two-dimensional symbols on the other; the latter may in turn be sub-divided into "multi-row bar code symbols", sometimes referred to as "stacked bar code symbols", and "two-dimensional matrix symbols". In addition, there is a hybrid group of symbologies known as "composite symbologies"; these symbols consist of two components carrying a single message or related data, one of which is usually a linear symbol and the other a two-dimensional symbol positioned in a defined relationship with the linear symbol.

Multi-row bar code symbols are constructed graphically as a series of rows of symbol characters, representing data and overhead components, placed in a defined vertical arrangement to form a (normally) rectangular symbol, which contains a single data message. Each symbol character has the characteristics of a linear bar code symbol character and each row has those of a linear bar code symbol; each row, therefore, may be read by linear symbol scanning techniques, but the data from all the rows in the symbol must be read before the message can be transferred to the application software.

Two-dimensional matrix symbols are normally square or rectangular arrangements of dark and light modules, the centres of which are placed at the intersections of a grid of two (sometimes more) axes; the coordinates of each module need to be known in order to determine its significance, and the symbol must therefore be analysed two-dimensionally before it can be decoded. Dot codes are a subset of matrix codes in which the individual modules do not directly touch their neighbours but are separated from them by a clear space.

Unless the context requires otherwise, the term "symbol" in this International Standard may refer to either type of symbology.

The bar code symbol must be produced in such a way as to be reliably decoded at the point of use, if it is to fulfil its basic objective as a machine-readable data carrier.

Manufacturers of bar code equipment and the producers and users of bar code symbols therefore require publicly available standard test specifications for the objective assessment of the quality of bar code symbols (a process known as verification), to which they can refer when developing equipment and application standards or determining the quality of the symbols. Such test specifications form the basis for the development of measuring equipment for process control and quality assurance purposes during symbol production as well as afterwards.

The performance of measuring equipment for the verification of symbols (verifiers) is the subject of a separate International Standard (ISO/IEC 15426, Parts 1 and 2).

This International Standard is intended to achieve comparable results to the linear bar code symbol quality standard ISO/IEC 15416, the general principles of which it has followed. It should be read in conjunction with the symbology specification applicable to the bar code symbol being tested, which provides symbology-specific detail necessary for its application. Two-dimensional multi-row bar code symbols are verified according to the ISO/IEC 15416 methodology, with the modifications described in Clause 6; different parameters and methodologies are applicable to two-dimensional matrix symbols.

There are currently many methods of assessing bar code quality at different stages of symbol production. The methodologies described in this International Standard are not intended as a replacement for any current process control methods. They provide symbol producers and their trading partners with universally standardized means for communicating about the quality of multi-row bar code and two-dimensional matrix symbols after they have been printed. The procedures described in this International Standard must necessarily be augmented by the reference decode algorithm and other measurement details within the

applicable symbology specification, and they may also be altered or overridden as appropriate by governing symbology or application specifications.

Alternative methods of quality assessment may be agreed between parties or as part of an application specification.

For direct part mark applications, a modified version of the methodology defined in this International Standard has been defined in ISO/IEC TR 29158.

Information technology — Automatic identification and data capture techniques — Bar code symbol print quality test specification — Two-dimensional symbols

1 Scope

This International Standard

— specifies two methodologies for the measurement of specific attributes of two-dimensional bar code symbols, one of these being applicable to multi-row bar code symbologies and the other to two-dimensional matrix symbologies;

— defines methods for evaluating and grading these measurements and deriving an overall assessment of symbol quality;

— gives information on possible causes of deviation from optimum grades to assist users in taking appropriate corrective action.

This International Standard applies to those two-dimensional symbologies for which a reference decode algorithm has been defined, but its methodologies can be applied partially or wholly to other similar symbologies.

While this International Standard can be applied to direct part marks, it is possible that better correlation between measurement results and scanning performance will be obtained with ISO/IEC TR 29158 in combination with this International Standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*

ISO/IEC 19762-2, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 2: Optically readable media (ORM)*

ISO 7724-2:1984, *Paints and varnishes — Colorimetry — Part 2: Colour measurement*

ISO/IEC 15416, *Information technology — Automatic identification and data capture techniques — Bar code print quality test specification — Linear symbols*

NOTE The Bibliography lists official and industry standards containing specifications of symbologies to which (inter alia) this International Standard is applicable.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762-1, ISO/IEC 19762-2, ISO/IEC 15416 and the following apply.

3.1
binarised image
binary (black/white) image created by applying the Global Threshold to the pixel values in the reference grey-scale image

3.2
effective resolution
resolution obtained on the surface of the symbol under test, normally expressed in pixels per millimetre or pixels per inch, and calculated as the resolution of the image capture element multiplied by the magnification of the optical elements of the measuring device

3.3
error correction capacity
number of codewords in a symbol (or error control block) assigned for erasure and error correction, minus the number of codewords reserved for error detection

3.4
inspection area
rectangular area which contains the entire symbol to be tested inclusive of its quiet zones

3.5
grade threshold
boundary value separating two grade levels, the value itself being taken as the lower limit of the upper grade

3.6
module error
module of which the apparent dark or light state in the binarised image is inverted from its intended state

3.7
pixel
individual light-sensitive element in an array [e.g. CCD (charge coupled device) or CMOS (complementary metal oxide semiconductor) device]

3.8
raw image
plot of the reflectance values in x and y coordinates across a two-dimensional image, representing the discrete reflectance values from each pixel of the light-sensitive array

3.9
reference grey-scale image
plot of the reflectance values in x and y coordinates across a two-dimensional image, derived from the discrete reflectance values of each pixel of the light-sensitive array by convolving the raw image with a synthesised circular aperture

3.10
reflectance margin
measurement of modulation using error correction and known module colours

3.11
sample area
area of an image contained within a circle 0,8X in diameter, X being the average module width determined by the application of the reference decode algorithm for the symbology in question or, where the application permits a range of X dimensions, the minimum module width permitted by the application specification

3.12
scan grade
result of the assessment of a single scan of a matrix symbol, derived by taking the lowest grade achieved for any measured parameter of the reference grey-scale and binarised images

4 Symbols and abbreviated terms

AN = Axial Nonuniformity

E_{cap} = error correction capacity of the symbol

e = number of erasures

FPD = Fixed Pattern Damage

GN = Grid Nonuniformity

GT = Global Threshold

MARGIN = a measure of the difference in reflectance between a module and the global threshold, the value of which goes to zero for modules of the incorrect reflectance state

MOD = an absolute measure of the difference in reflectance between a module and the global threshold

R_{max} = highest reflectance in any element or quiet zone in a scan reflectance profile, or the highest reflectance of any sample area in a two-dimensional matrix symbol

R_{min} = lowest reflectance in any element in a scan reflectance profile, or the lowest reflectance of any sample area in a two-dimensional matrix symbol

SC = Symbol Contrast (equal to R_{max} - R_{min})

t = number of errors

UEC = Unused Error Correction

5 Quality grading

5.1 General

The measurement of two-dimensional bar code symbols is designed to yield a quality grade indicating the overall quality of the symbol which can be used by producers and users of the symbol for diagnostic and process control purposes, and which is broadly predictive of the read performance to be expected of the symbol in various environments. The process requires the measurement and grading of defined parameters, from which a grade for an individual scan (scan reflectance profile grade or scan grade) is derived; the grades of multiple scans of the symbol are averaged to provide the overall symbol grade.

As a consequence of the use of different types of reading equipment under differing conditions in actual applications, the levels of quality required of two-dimensional bar code symbols to ensure an acceptable level of performance will differ. Application specifications should therefore define the required performance in terms of overall symbol grade in accordance with this standard. The guidelines in Annex D.4 are provided as an aid in writing application standards which employ this standard.

This standard defines the method of obtaining a quality grade for individual symbols. The use of this method in high volume quality control regimes may require sampling in order to achieve desired results. Such sampling plans, including required sampling rates are outside of the scope of this international standard.

NOTE Information on sampling plans may be found in the following: ISO 3951-1, ISO 3951-2, ISO 3951-3, ISO 3951-5 or ISO 2859-10.

5.2 Expression of quality grades

Although this International Standard specifies a numeric basis for expressing quality grades on a descending scale from 4 to 0, with 4 representing the highest quality, individual parameter grades and individual scan grades may also be expressed on an equivalent alphabetic scale from A to D, with a failing grade of F, in application standards with a historical link to ANSI X3.182.

Table 1 maps the alphabetic and numeric grades to each other.

Table 1 — Equivalence of numeric and alphabetic quality grades

Numeric grade	Alphabetic Grade
4	A
3	B
2	C
1	D
0	F

5.3 Overall Symbol Grade

The overall symbol grade shall be calculated as defined in 6.2.6 or 7.10. Overall symbol grades shall be expressed to one decimal place on a numeric scale ranging in descending order of quality from 4,0 to 0,0.

Where a specification defines overall symbol grades in alphabetic terms the relative mapping of the alphabetic and numeric grades is as illustrated in Figure 1 below. For example, the range of 1,5 to immediately below 2,5 corresponds to grade C.

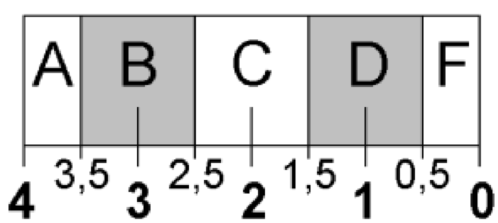


Figure 1 — Mapping of alphabetic and numeric overall symbol grades

5.4 Reporting of symbol grade

A symbol grade is only meaningful if it is reported in conjunction with the illumination and aperture used. It should be shown in the format *grade/aperture/light/angle*, where:

- "*grade"* is the overall symbol grade as defined in 6.2.6 or 7.10, i.e. the arithmetic mean to one decimal place of the scan reflectance profile or scan grades,

- *"aperture"* is the aperture reference number (from ISO/IEC 15416 for linear scanning techniques, or the diameter in thousandths of an inch (to the nearest thousandth) of the synthetic aperture defined in 7.3.3),

- "*light"* defines the illumination: a numeric value indicates the peak light wavelength in nanometres (for narrow band illumination); the alphabetic character W indicates that the symbol has been measured with broadband illumination ("white light") the spectral response characteristics of which must imperatively be defined or have their source specification clearly referenced,

- *"angle"* is an additional parameter defining the angle of incidence (relative to the plane of the symbol) of the illumination. It shall be included in the reporting of the overall symbol grade when the angle of incidence is other than 45°. Its absence indicates that the angle of incidence is 45°.

NOTE While illumination from four sides with an angle of incidence of 45° is the default, other angles of incidence may be specified as requirements for grading by specifying the angle instead of leaving it blank. Other lighting options are defined in ISO/IEC TR 29158 which may be more appropriate for direct part marking applications, especially in applications which rely on symbols marked on reflectance substrates.

An asterisk following the value for "grade", in the case of a two-dimensional matrix symbol, indicates that the surroundings of the symbol contain extremes of reflectance that may interfere with reading - see 7.6.

Examples

2,8/05/660 would indicate that the average of the grades of the scan reflectance profiles, or of the scan grades, was 2,8 when these were obtained with the use of a 0,125 mm aperture (ref. no. 05) and a 660 nm light source, incident at 45°.

2,8/10/W/30 would indicate the grade of a symbol intended to be read in broadband light, measured with light incident at 30° and using a 0,250 mm aperture (ref. no. 10), but would need to be accompanied either by a reference to the application specification defining the reference spectral characteristics used for measurement or a definition of the spectral characteristics themselves.

2,8*/10/670 would indicate the grade of a symbol measured using a 0,250 mm aperture (ref. no. 10), and a 670 nm light source, and indicates the presence of a potentially interfering extreme reflectance value in the surroundings of the symbol.

NOTE The same notation is used to specify a minimum grade that is required in an application as is a grade that is obtained by measuring a symbol in accordance with this standard. For example, an application standard may specify a symbol quality requirement as 1.5/05/660 and this would be met by a measured grade of X.X/05/660 as long as X.X is a number that is greater or equal to 1.5. However, this requirement would not be met by 2.0/10/660 nor 3.0/05/W nor 3.5/05/660/30.

6 Measurement methodology for two-dimensional multi-row bar code symbols

6.1 General

The evaluation of two-dimensional multi-row bar code symbols shall be based on the application of the methodology of ISO/IEC 15416, modified as described in 6.2.2 or 6.3, and if appropriate for the symbology, on the application of the additional provisions described in 6.2.3, 6.2.4 and 6.2.5, to derive an overall symbol grade. Ambient light levels shall be controlled in order not to have any influence on the measurement results. The symbol shall be scanned using the light wavelength(s) and effective aperture size specified in the appropriate application standard. When performing a measurement, the scan lines should be made perpendicular to the height of the bars in the start and stop characters and should as far as possible pass through the centres of rows in order to minimise the effect of cross-talk from adjacent rows. In the case of area

imaging techniques, a number of scan lines, perpendicular to the height of the bars and sufficient to cover all rows of the symbol, shall be synthesised by convolving the raw image with the appropriate synthetic aperture.

6.2 Symbologies with cross-row scanning ability

6.2.1 Basis of grading

The distinguishing feature of these symbologies is their ability to be read with scan lines that cross row boundaries. Symbologies of this type, at the date of publication of this International Standard, also share the feature that the start and stop patterns (or equivalent features of the symbol, e.g. the Row Address Patterns of MicroPDF417) are constant from row to row, or the position of only one edge in these patterns varies by no more than 1X in adjacent rows of the symbol. These symbologies shall be graded in respect of:

— Analysis of the scan reflectance profile (based on ISO/IEC 15416) (see 6.2.2)

— Codeword Yield (see 6.2.3)

— Unused Error Correction (see 6.2.4)

— Codeword print quality (see 6.2.5)

6.2.2 Grade based on analysis of scan reflectance profile

The start and stop or equivalent (e.g. Row Address) patterns of the symbol shall be evaluated according to ISO/IEC 15416. Regions with data content will be evaluated separately as described in 6.1.2, 6.1.3 and 6.1.4. Test scans of the Start and Stop patterns shall be graded using all parameters specified in ISO/IEC 15416.The effective aperture size is specified in the appropriate application standard or is the default aperture size appropriate for the symbol X dimension given in ISO/IEC 15416.

For the analysis of the scan reflectance profiles, the number of scans should be ten, or the height of the symbol divided by the measuring aperture if this quotient is less than ten. Scans should be approximately evenly spaced over the height of the symbol. For example, in a twenty-row symbol the ten scans might be performed in alternate rows. In a two-row symbol, up to five scans might be performed in each row, at different positions in the height of the bars. The symbology specification may give more specific guidance on the selection of the scans to be used.

To identify bars and spaces, a Global Threshold for each scan has to be determined. Global Threshold shall be equal in reflectance to $(R_{max} + R_{min}) / 2$, where the values R_{max} and R_{min} are respectively the highest and the lowest reflectances in the scan. All regions above the Global Threshold shall be considered spaces (or quiet zones) and all regions below shall be considered bars.

Edge locations shall be determined as the points where the reflectance value is midway between the highest reflectance in the adjoining space and the lowest reflectance in the adjoining bar, in accordance with ISO/IEC 15416.

For the evaluation of the parameters 'decode' and 'decodability' the reference decode algorithm for the symbology shall be applied.

Each scan shall be graded as the lowest grade for any individual parameter in that scan. The grade based on scan reflectance profiles shall be the arithmetic mean of the grades for the individual scans.

The measurement of bar width gain or loss may be used for process control purposes. Note that this method will not be sensitive to printing variations parallel to the height of the start and stop characters. If a full analysis of the printing process is desired, symbols should be printed and tested in both orientations.

6.2.3 Grade based on Codeword Yield

This parameter measures the efficiency with which linear scans can recover data from a two-dimensional multi-row symbol. The Codeword Yield is the number of validly decoded codewords expressed as a percentage of the maximum number of codewords that could have been decoded (after adjusting for tilt). A poor Codeword Yield, for a symbol whose other measurements are good, may indicate a Y-axis print quality problem (such as those shown in Table C.1).

Obtain a matrix of the correct symbol character values, such as would result from successful completion of the *UEC* calculations (see 6.2.4). This matrix is used as the "final decode of the symbol" used in subsequent steps to determine validly decoded codewords.

An individual scan qualifies for inclusion in the Codeword Yield calculation if it meets either of two conditions:

1) The scan did not include recognised portions of either the top or the bottom row of the symbol. At least one of the Start or Stop (or Row Address) patterns shall have been successfully decoded from that scan, together with at least one additional codeword or the corresponding second Start or Stop pattern, or Row Address Pattern.
2) The scan included recognised portions of either the top or the bottom row of the symbol. Both the Start and Stop patterns of the symbol shall have been successfully decoded from that scan.

It is important to note that an extension to the symbology's Reference Decode Algorithm is required, in order to detect and decode a pair of Start and Stop patterns when neither of the adjacent codewords is decodable. As examples, a linear search for a matching pair of PDF417 Start and Stop patterns, or a linear search for a matching pair of MicroPDF417 Row Indicator Patterns, would fulfil this requirement for scans where the Reference Decode Algorithm alone did not decode both patterns; thus this extension can qualify a scan where no codewords (other than the matched end patterns) were decoded. Note however, that a scan that contains only a *single* decoded Start or Stop pattern found by this linear search does not count as a qualified scan, if no other codewords or corresponding second Start or Stop pattern, or Row Address Pattern, were also decoded.

Decode the symbol completely and populate the symbol matrix.

For each qualified scan, compare the codewords actually decoded with the codewords in the symbol matrix and count the number of codewords that match. Accumulate the total number of validly decoded codewords, and update a count of the number of times each codeword of the symbol has been decoded and a count of the number of times each row has been detected. Also record a count of the number of detected row crossings in each scan (a crossing is "detected" when a scan line yields correctly-decoded codewords from adjacent rows).

After processing each scan, calculate the maximum number of codewords that could have been decoded thus far, as the number of qualified scans multiplied by the number of columns in the symbol (excluding the fixed patterns, such as the Start and Stop patterns of PDF417 or the Row Address Indicators of MicroPDF417).

The entire symbol shall be scanned multiple times until three conditions are met:

1) the maximum number of codewords that could have been decoded is at least ten times the number of codewords in the symbol,
2) the highest and lowest decodable rows (which may not necessarily be the first and last rows) of the symbol have each been scanned at least three times, and
3) at least (0.9*n*) of the codewords (data or error correction) have been successfully decoded two or more times, where *n* is the number of non-error-correction data codewords in the symbol.

EXAMPLE Taking a PDF417 symbol with 6 rows and 16 columns and error correction level 4, the total number of codewords is 96, of which 64 are data and 32 error correction. To fulfil condition 1, the maximum number of codewords that could have been decoded must be at least 960. To fulfil condition 3, since n is 64, at least 58 of the codewords must have been decoded twice or more ($0,9 \times 64 = 57,6$).

If the ratio of the total number of validly decoded codewords to the total number of detected row crossings is less than 10 : 1, then discard the measurements just obtained, and repeat the measurement process, adjusting the tilt angle of the scan line to reduce the number of row crossings.

Otherwise, to compensate for any residual tilt, subtract the number of detected row crossings from the calculated maximum number of codewords that could have been decoded.

Codeword Yield shall be graded as shown in Table 2:

Table 2 — Grading of Codeword Yield

Codeword Yield	Grade
≥ 71%	4
≥ 64%	3
≥ 57%	2
≥ 50%	1
< 50%	0

6.2.4 Grade based on unused error correction

Decode the symbol completely and process scans until the number of decoded codewords stabilises. Calculate the unused error correction (*UEC*) as $UEC = 1{,}0 - ((e + 2t) / E_{cap})$, where e = the number of erasures, t = the number of errors and E_{cap} = the error correction capacity of the symbol (the number of error correction codewords minus the number of error correction codewords reserved for error detection). If no error correction has been applied to the symbol, and if the symbol decodes, $UEC = 1$. If $(e + 2t)$ is greater than E_{cap}, $UEC = 0$. In symbols with more than one (e.g. interleaved) error correction block, *UEC* shall be calculated for each block independently and the lowest value shall be used for grading purposes.

Unused Error Correction shall be graded as shown in Table 3:

Table 3 —Grading of Unused Error Correction

Unused Error Correction	Grade
≥ 0,62	4
≥ 0,50	3
≥ 0,37	2
≥ 0,25	1
< 0,25	0

6.2.5 Grade based on codeword print quality

The approach detailed in this subclause provides additional diagnostic information and enables allowance to be made for the effect of error correction in masking less than perfect attributes of the symbol that influence symbol quality, by applying an overlay technique as described in Annex F. It enables the Decodability, Defects and Modulation parameters of scan reflectance profiles covering the entire data region of the symbol to be graded in accordance with ISO/IEC 15416.

This approach uses the following procedure for the assessment of each of the three parameters. In symbols with more than one (e.g. interleaved) error correction block, it shall be applied to each block independently and the lowest value shall be used for grading purposes.

The entire symbol shall be scanned until 0.9*n* codewords (where *n* has the same meaning as in 6.2.3) have been decoded ten times or until it is certain that each codeword has been scanned at least once without inter-row interference. In each scan, the Decodability, Defects and Modulation parameters shall be measured in each symbol character in accordance with ISO/IEC 15416. The calculation of all three parameters shall be based on the value of Symbol Contrast obtained from R_{max} and R_{min} in that scan line. The interim codeword grade of each parameter (Modulation, Defects and Decodability) for each codeword is the highest codeword grade for that parameter obtained on any scan for that codeword.

Where the rows include overhead characters (other than the Start and Stop, or equivalent patterns), for example Row Indicators in PDF417 symbols, that are not included in the error correction calculation, these overhead characters shall be assessed first for each row together with the corresponding characters from the rows immediately above and below the row being considered. The highest interim codeword grade for any of these six (or four, in the case of the top or bottom row) characters shall be the overhead grade used to moderate the interim codeword grades for the codewords in the row. If a data codeword's interim codeword grade is higher than the grade obtained by the overhead characters, the data codeword's interim codeword grade shall be reduced to the overhead grade. The interim parameter grades so obtained shall then be modified to allow for the influence of error correction, as described below.

For each parameter, the cumulative number of symbol characters achieving each grade from 4 to 0 or a higher grade, and those not decoded, shall be counted, and the counts shall be compared with the error correction capacity of the symbol as follows:

For each grade level, assuming that all symbol characters not achieving that grade or a higher grade are erasures, derive a notional grade for Unused Error Correction as described in 6.2.4, based on the percentage thresholds shown in Table 3. The codeword parameter grade shall be the lower of the grade level and the notional UEC grade.

NOTE 1 This notional grade is not related to, and does not affect, the UEC grade for the symbol as calculated according to 6.2.4, but is a means of compensating for the extent to which error correction can mask imperfections in a symbol. If one symbol has higher error correction capacity than another symbol, then the former symbol can tolerate a greater number of codewords with poor values for the parameter in question than the latter. See Annex F for a fuller description of the approach. The final codeword parameter grade for the symbol shall be the highest codeword interim grade for all grade levels.

Table 4 shows an example of grading one parameter in a symbol containing 100 symbol characters (codewords) with an error correction capacity of 32 codewords. The 100 codewords consist of 68 data codewords, 3 error correction codewords reserved for error detection, and 29 error correction codewords to be used for correcting erasures or errors, giving an erasure correction capacity of 29. The symbol would be graded 1 for the parameter concerned (the highest value in the right-hand column).

NOTE 2 A similar calculation is performed for each of the parameters Modulation, Defects and Decodability

Table 4 — Example of codeword print quality parameter grading in symbols with cross-row scanning ability, applying overlay procedure in Annex F

***MOD*/Defects/Decodability grade level (a)**	**No. of codewords at level a**	**Cumulative no. of codewords at level a or higher (b)**	**Remaining codewords (treated as erasures) (100 - b) (c)**	**Notional unused error correction capacity (29 – c)**	**Notional UEC (%)**	**Notional UEC grade (d)**	**Codeword interim grade level (Lower of a or d) (e)**
4	40	40	60	(exceeded)	<0	0	0
3	20	60	40	(exceeded)	<0	0	0
2	10	70	30	(exceeded)	<0	0	0
1	10	80	20	9	31%	1	1
0	7	87	13	16	55%	3	0
Not decoded	13	100					
					Parameter grade (Highest value of **e**)		1

6.2.6 Overall symbol grade

The overall symbol grade shall be the lowest of the grade based on analysis of the scan reflectance profile in accordance with 6.2.2, and the grades based on Codeword Yield, Unused Error Correction and codeword print quality in accordance with 6.2.3, 6.2.4 and 6.2.5.

The flowchart in Figure 2 summarises the process.

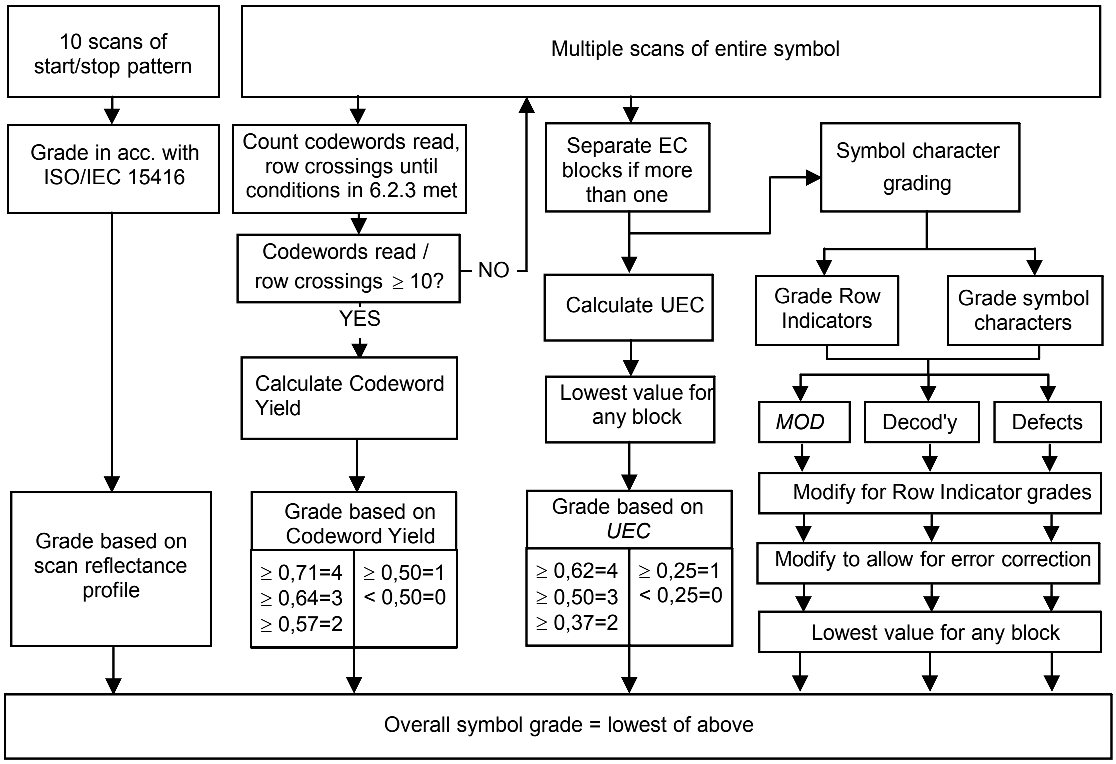


Figure 2 — Grading process for multi-row symbols with cross-row scanning ability

6.3 Symbologies requiring row-by-row scanning

The distinguishing feature of these symbologies is that they require a scan line to traverse a complete row from start to stop pattern (or in the reverse direction) without crossing into an adjacent row and that they require all rows to be scanned.

Each row shall be evaluated in accordance with ISO/IEC 15416 as though it were a separate symbol. Scan lines shall pass through the inspection band of the central 80% of the height of each row, as specified in ISO/IEC 15416, in order to minimise the effects of cross-talk from adjacent rows. The number of scans per row should be the lower of ten, or the inspection band height divided by the aperture diameter. The overall symbol grade shall be the lowest overall grade obtained for any row.

7 Measurement methodology for two-dimensional matrix symbols

7.1 Overview of methodology

The measurement methodology defined in this clause is designed to maximize the consistency of both reflectivity and dimensional measurements of symbols on various substrates. The basis of this methodology is the measurement of reflectance from the symbol. This methodology is also intended to correlate with conditions encountered in two-dimensional matrix scanning systems.

The method starts by obtaining the raw image, which is a high-resolution grey-scale image of the symbol captured under controlled illumination and viewing conditions. The stored raw image is then converted into a

reference grey-scale image, by convolving the raw image with a synthetic circular aperture. From the reference grey-scale image, the Symbol Contrast, Modulation and Fixed Pattern Damage parameters are measured and graded. A secondary binarised image is produced from the reference grey-scale image by applying a Global Threshold, and this binarised image is then analysed and graded for the parameters of Decode, Axial Nonuniformity, Grid Nonuniformity, and Unused Error Correction, together with any additional parameters defined in the symbology or application specification. The methodology recognises possible extreme reflectance values in the neighbourhood of the symbol, which might interfere with reading; however, only their presence is indicated in the report of the overall symbol grade.

In addition, print growth or loss is measured along each axis of the symbol and reported as an ungraded process control measurement.

The scan grade is the lowest grade achieved for these seven parameters and any others specified for a given symbology or application.

7.2 Obtaining the test images

7.2.1 Measurement conditions

A test image of the symbol shall be obtained in a configuration that mimics the typical scanning situation for that symbol, but with substantially higher resolution (see 7.3.3), uniform illumination, and at best focus. The reference optical arrangement is defined in 7.3.4 and should be used where application requirements do not call for a specialised optical arrangement; alternative optical arrangements (two of which are defined in 7.3.4) may be used provided that the measurements obtained with them can be correlated with the use of the reference optical arrangement.

Measurements shall be made with light of a single peak wavelength or set of spectral characteristics and a known diameter of measuring aperture, both of which shall be defined by the application specification or determined in accordance with 7.3.2 and 7.3.3. Ambient light levels shall be controlled in order not to have any influence on the measurement results.

Whenever possible, measurements shall be made on the symbol in its final configuration, i.e. the configuration in which it is intended to be scanned. The measurement method is described in 7.6 and 7.7, and Annex B, and is intended to prevent extreme reflectance values outside the symbol area (e.g. when surrounded by free air or a highly specularly reflective surface) from distorting the symbol contrast measurements.

Specialized applications (e.g. the measurement of quality of symbols produced by engraving or etching the substrate surface) clearly must dictate the colour and angle of symbol illumination as well as the required imaging resolution, but the general test set-up defined in 7.3.4 should work suitably for many open applications. For Direct Part Mark applications, a modified version of the methodology described in this standard may be more appropriate. The modified methodology is formally defined in ISO/IEC TR 29158 and may be followed if such is in accordance with the relevant application standard.

Two principles govern the design of the optical set-up. First, the test image's grey-scale shall be nominally linear and not be enhanced in any way. Second, the image resolution shall be adequate to produce consistent readings. See 7.3.3.

7.2.2 Raw image

The raw image is a plot of the actual reflectance values for each pixel of the light-sensitive array, from which are derived the reference grey-scale image and the binarised image which are evaluated for the assessment of symbol quality.

7.2.3 Reference grey-scale image

The reference grey-scale image is obtained from the raw image by processing the individual pixel reflectance values through a synthetic circular aperture as defined in 7.3.3. It is used for the assessment of the parameters Symbol Contrast, Modulation, Reflectance Margin and Fixed Pattern Damage.

7.2.4 Binarised image

The binarised image is obtained from the reference grey-scale image by applying a Global Threshold midway between R_{max} and R_{min}, determined as defined in 7.6. It is used for the assessment of the parameters Decode, Axial Non-uniformity, Grid Non-uniformity, and Unused Error Correction.

7.3 Reference reflectivity measurements

7.3.1 General requirements

Equipment for assessing the quality of symbols in accordance with this clause shall comprise a means of measuring and analysing the variations in the reflectivity of a symbol on its substrate over an inspection area which shall cover the full height and width of the symbol including all quiet zones.

All measurements on a two-dimensional matrix symbol shall be made within the inspection area defined in accordance with 7.3.5.

The measured reflectance values shall be expressed in percentage terms either with reference to the reflectance of a barium sulphate or magnesium oxide reference sample complying with the requirements of ISO 7724-2, which shall be taken as 100 per cent, or by means of calibration and reference to recognised national standards laboratories.

7.3.2 Light source

The peak light wavelength or, in the case of applications designed for the use of broadband illumination, the reference spectral response characteristics, should be specified in the application specification to suit the intended scanning environment. When the peak wavelength or spectral characteristics are not specified in the application specification, measurements should be made using light of characteristics that approximate most closely to those expected to be used in the scanning process. Light sources may either have inherently narrow band or near-monochromatic characteristics or have broad bandwidths; in the latter case the spectral response of the measuring system may be restricted to the desired peak wavelength(s) by the interposition of an appropriate narrow band filter in the optical path.

NOTE Special care is necessary when making measurements with broadband illumination. The overall spectral response of the measurement and reading systems must be defined and matched in order to make accurate and repeatable measurements of the grey-scale reflectance of a sample area that correlate with the intended system. Overall spectral response includes the spectral distribution of the light source, the response of the detector and any associated filter characteristics.

Refer to Annex D for guidance on the selection of the light source.

7.3.3 Effective resolution and measuring aperture

The measuring aperture is specified by the user application specification to suit the *X* dimension of the symbol and the intended scanning environment. Matrix symbol grading shall be carried out using a synthesised aperture. An aperture size in the range of 50% to 80% of the smallest *X* dimension to be encountered in an application is recommended. In an application where symbols of differing *X* dimensions will be encountered, the application standard should ensure that all measurements are made with the aperture appropriate to the smallest *X* dimension to be encountered. See Annex D.2 for guidance in writing application standards and considering the tradeoffs associated with the choice of aperture size.

The effective resolution of an instrument that implements this international standard shall be sufficient to ensure that the parameter grading results are consistent irrespective of the rotation of the symbol. The effective resolution is the product of the resolution of the light-sensitive array and of the magnification of the associated optical system and effected by distortions introduced by the optical system. The reference optical arrangement requires high resolution, such as an effective resolution of not less than ten pixels per module in width and height.

NOTE Implementations (e.g. commercial verifiers) may use fewer pixels per module, providing that the consistency irrespective of rotation mentioned above is achieved on the test symbols specified in ISO/IEC 15426-2.

7.3.4 Optical geometry

A reference optical geometry is defined for reflectivity measurements and consists of:

— flood incident illumination, uniform across the inspection area, from a set of four light sources arranged at 90 degree intervals around a circle concentric with the inspection area and in a plane parallel to that of the inspection area, at a height which will allow incident light to fall on the centre of the inspection area at an angle of 45° to its plane, and

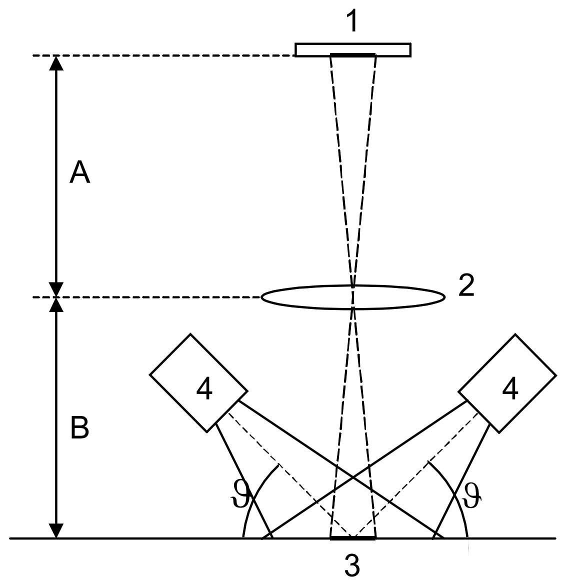
— a light collection device, the optical axis of which is perpendicular to the inspection area and passes through its centre, and which focuses an image of the test symbol on a light-sensitive array.

The light reflected from the inspection area (see 7.3.5) plus the 20*Z* extension defined in 7.7 shall be collected and focussed on the light-sensitive array.

Implementations may use alternative optical geometries and components, provided that their performance can be correlated with that of the reference optical arrangement defined in this section. Figures 3 and 4 illustrate the principle of the optical arrangement, but are not intended to represent actual devices; in particular the magnification of the device is likely to differ from 1:1. In addition, many devices include filters to modify the spectral characteristics or restrict the effect of unwanted spectral components. Implementations should have sufficient resolution irrespective of the rotation as stated in 7.3.3, unless the manufacturer defines handling instructions which restricts the angle of the symbol in relation to the camera chip orientation.

This reference geometry is intended to provide a basis to assist the consistency of measurement and may not correspond with the optical geometry of individual scanning systems. As stated in 7.2, specialised applications, and especially those involving direct part marking which employs physical changes to the surface of the substrate for the creation of the graphic image, may require the angle of illumination, in particular, to be set to a different particular angle such as 30° to the plane of the symbol. If an angle other than the default is specified in the application specification, then the angle of incidence of the light shall be stated as a fourth parameter when reporting the overall symbol grade, as described in 5.4.

The modified methodology defined in ISO/IEC TR 29158 intended for direct part marking applications defines more illumination options including diffuse illumination at a near-90° incident angle.



1 – Light sensing element

2 – Lens providing 1:1 magnification (measurement *A* = measurement *B*)

3 – Inspection area

4 – Light sources

ϑ - Angle of incidence of light relative to plane of symbol (default = 45°, optionally 30° or 90° diffuse)

Figure 3 — Reference optical arrangement – side view

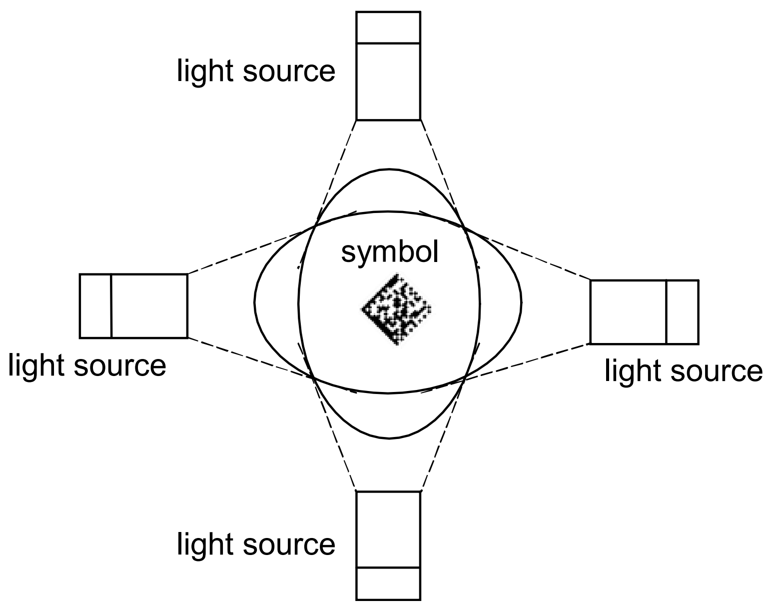


Figure 4 — Reference optical arrangement – plan view

7.3.5 Inspection area

The area within which all measurements shall be made shall be a rectangular area framing the complete symbol, including quiet zones. The centre of the inspection area shall be as close as practicable to the centre of the field of view.

NOTE The inspection area is not the same as the field of view of the verifier, which should be sufficiently large to include the whole symbol plus the 20*Z* extension described in 7.7.

7.4 Number of scans

The overall symbol grade is obtained through one measurement, with the symbol oriented in any rotation with respect to the measuring device, in a plane perpendicular to the optical axis to the imager sensor. See D.5 for information regarding the fact that this international standard previously required five scans at different rotations to be made and averaged to obtain an overall grade.

Note: This may not be appropriate for symbols on certain substrates or marking methods that do not exhibit uniform diffuse reflection and therefore exhibit variations in symbol reflectance characteristics when viewed in different orientations relative to the axis of the measuring device. Such symbols may be more appropriately measured by following the modified methodology in ISO/IEC TR 29158.

7.5 Basis of scan grading

Two-dimensional symbol quality assessment shall be based on the measurement and grading of parameters of the reference grey-scale image, the binarised image derived from it, and the application of the reference decode algorithm to these, as defined in 7.8. Quality grading of these parameters shall be used to provide a relative measure of symbol quality under the measurement conditions used. Each parameter shall be measured and a grade on a descending scale of integers from 4 to 0 shall be allocated to it. The grade 4 represents the highest quality, while the grade 0 represents failure.

7.6 Grading procedure

A flowchart illustrating the procedure is shown in Annex B.

Centre the symbol in the field of view

Capture the raw image (see 7.2.2).

Find and replace the brightest .005% pixels in the overall image with the median of the nine pixels consisting of itself and its eight immediate neighbours.

Apply the aperture defined in 7.3.3 to the raw image to create a reference grey-scale image (see 7.2.3).

A circular area with a diameter 20 times the aperture diameter, centred in the reference grey-scale image, should be used to find the initial values for R_{min} and R_{max}. Using these values, determine an initial Global Threshold, create a binarised image (see 7.2.4), find the symbol and perform an initial decode.

Once the symbol has been decoded, measure revised R_{min} and R_{max} and recalculate the Global Threshold based on the whole inspection area of the reference grey-scale image (including the quiet zone). These values are used to recalculate module centres. Create a new binarised image. Perform a definitive decode and calculate all of the graded parameters of the symbol. Based on these, determine the scan grade for that image.

7.7 Additional reflectance check over extended area

If the scan grade for each of modulation, decode, and finder pattern damage is 1 or higher, then perform an additional reflectance check as follows:

> Measure R_{min} and R_{max} over an area extending to 20Z beyond the quiet zone on all sides. The field of view must be large enough to contain all points in the extended area.
>
> If either the extended-area R_{min} is lower than the revised R_{min}, or the extended-area R_{max} is higher than the revised R_{max}, then repeat the measurement of modulation and finder pattern damage. If that measurement results in a modulation or finder pattern damage grade of 0, then an asterisk is appended to the overall symbol grade. This asterisk indicates that the substrate surrounding the symbol contains extremes of reflectance that may interfere with reading.

NOTE This additional reflectance check does not alter the reported overall symbol grade nor the reported grades for the symbol contrast, modulation or finder pattern damage parameters.

The additional reflectance check may be omitted, if specifically permitted by the application specification, where the conditions under which the symbol is produced and applied are such that the risk of excessively high or low reflectance values in the extended area is insignificant, and the verifier field of view may then include only the symbol and its associated quiet zones.

7.8 Image assessment parameters and grading

7.8.1 Use of reference decode algorithm

The symbology reference decode algorithm found in the symbology specification is to be used in the verification process. In order to simplify processing the reference decode algorithm may be modified in the verifier by assuming that the symbol to be verified is approximately centred in the field of view of the device. No modifications to the reference decode algorithm that alter the functions listed below (since the adaptive grid mapping are essential to the grading process defined herein) are to be made. The reference decode performs five tasks needed for subsequent measurement of the symbol quality parameters.

- It locates and defines the area covered by the test symbol in the image.
- It determines reference points from the fixed patterns of the symbol to be used in constructing an ideal grid for measuring GNU.
- It adaptively creates a grid mapping of the data module nominal centres so as to sample them.
- It determines the nominal grid centre spacings in each axis of the symbol (the symbol X dimension)
- It performs error correction, detecting if symbol damage has consumed any of the error budget.
- It attempts to decode the symbol.

These functions each facilitate one or more of the measurements described in the following subclauses.

The image parameters described in 7.8.2 to 7.8.9 shall be assessed for compliance with this standard.

7.8.2 Decode

The Decode parameter tests, on a Pass/Fail basis, whether the symbol has all its features sufficiently correct to be readable by the reference decode algorithm.

The symbology reference decode algorithm shall be used to decode the symbol using the module centre positions on the grid determined by processing the binarised image.

If the image cannot be decoded using the symbology reference decode algorithm, then it shall receive the failing grade 0. Otherwise, it shall receive the grade 4.

7.8.3 Symbol Contrast

Symbol Contrast tests that the two reflective states in the symbol, namely light and dark, are sufficiently distinct within the symbol.

Using the reference grey-scale image of the symbol, measure the highest and lowest reflectance values in the inspection area. Symbol contrast is the difference between the highest and lowest reflectance values in the inspection area. The reflectance values to be used are the revised R_{max} and R_{min} as defined in 7.6.

$$SC = R_{max} - R_{min}$$

Symbol contrast shall be graded as shown in Table 5.

Table 5 — Symbol Contrast grading

Symbol Contrast	Grade
≥ 70%	4
≥ 55%	3
≥ 40%	2
≥ 20%	1
< 20%	0

7.8.4 Modulation and related measurements

7.8.4.1 Modulation

Modulation is a measure of the uniformity of reflectance of the dark and light modules respectively. Factors such as print growth (or loss), misplacement of a module relative to the grid intersection, the optical characteristics of the substrate and uneven printing may reduce the absolute value of the difference between the reflectance of a module and the Global Threshold. A low Modulation may increase the probability of a module being incorrectly identified as dark or light.

The reflectance value of each module in the symbol shall be measured by superimposing on the reference grey-scale image the grid determined by applying the symbology reference decode algorithm to the binarised image. Calculate MOD, the Modulation value of each module as follows:

$$MOD = 2 * (\text{abs}(R - GT)) / SC$$

Where MOD = modulation
R is the reflectance of the module
GT is the Global Threshold
SC is the Symbol Contrast

Assign the grade level for each module according to Table 6. For each codeword, select the minimum modulation grade of all modules in the codeword. As suggested by the absolute value in the function for MOD, whether a codeword is decoded correctly has no bearing on the grade level that is assigned. In this way, Modulation differs from Reflectance Margin, see 7.8.4.3.

Table 6 — Module grading for Modulation and Reflectance Margin

MOD or MARGIN	Module Grade
≥ 0,50	4
≥ 0,40	3
≥ 0,30	2
≥ 0,20	1
< 0,20	0

The cumulative number of codewords achieving each grade shall be counted and compared with the error correction capacity of the symbol as follows:

For each grade level, assuming that all codewords not achieving that grade or a higher grade are errors, derive a notional Unused Error Correction grade as described 7.8.8. Take the lower of the grade level and the notional UEC grade.

NOTE This notional grade is not related to, and does not affect, the *UEC* grade for the symbol as calculated according to 7.8.8, but is a means of compensating for the extent to which error correction can mask imperfections in a symbol. If one symbol has higher error correction capacity than another symbol, then the former symbol can tolerate a greater number of codewords with low modulation than the latter. See Annex F for a fuller description of the approach.

Then the Modulation grade for the symbol shall be the highest of the resulting values for all grade levels. When the symbol consists of more than one (e.g. interleaved) error correction block, each block shall be assessed independently and the lowest grade for any block shall be taken as the Modulation grade of the symbol.

Table 7(A) shows an example of grading Modulation in a symbol containing 120 codewords, 60 of which are error correction codewords with a capacity to correct up to 30 errors in a single error correction block. Modulation grade of the symbol in the example would be 2 (the highest value in the right-hand column).

Table 7(A) — Example of Modulation grading in a two-dimensional matrix symbol

MOD codeword grade level (**a**)	No. of codewords at level **a**	Cumulative no. of codewords at level **a** or higher (**b**)	Remaining codewords (treated as errors) (120 - **b**) (**c**)	Notional unused error correction capacity (30 – **c**)	Notional *UEC* (%)	Notional *UEC* grade (**d**)	Lower of **a** or **d** (**e**)
4	25	25	95	(exceeded)	<0	0	0
3	75	100	20	10	33,3%	1	1
2	15	115	5	25	83,3%	4	**2**
1	3	118	2	28	93.3%	4	1
0	2	120	0	30	100%	4	0
					Modulation grade (Highest value of **e**):		2

In this example, some codewords may contain errors but that does not affect the calculation.

7.8.4.2 Contrast Uniformity

Contrast Uniformity is an optional parameter that can be a useful process control tool for measuring localized contrast variations. Contrast Uniformity does not affect the overall grade.

Contrast Uniformity is defined as the minimum MOD value found in any module contained in the data region of the symbol in clause 7.8.4.1.

7.8.4.3 Reflectance Margin

Reflectance Margin is a measure of how well each module is correctly distinguishable as light or dark in comparison to the global threshold. Factors such as print growth (or loss), misplacement of a module relative to the grid intersection, the optical characteristics of the substrate, uneven printing, or encodation errors, may reduce or even eliminate the margin for error between the reflectance of a module and the Global Threshold. A low Reflectance Margin may increase the probability of a module being incorrectly identified as dark or light.

The reflectance value of each module in each codeword in the symbol shall be measured by superimposing on the reference grey-scale image the grid determined by applying the symbology reference decode algorithm to the binarised image.

Since the correct state of each module is known after decoding, any modules which are decoded incorrectly are assigned a *MARGIN* value of 0.

For modules whose correct state is light:

$$MARGIN = 2 * (R - GT) / SC \text{ for } R \geq GT$$

$$\text{MARGIN} = 0 \text{ for } R < GT$$

and for modules whose correct state is dark:

$$MARGIN = 2 * (GT - R) / SC \text{ for } R < GT$$

$$\text{MARGIN} = 0 \text{ for } R \geq GT$$

Where *MARGIN* = the reflectance margin of the module
R is the reflectance of the module
GT is the Global Threshold
SC is the Symbol Contrast

Assign the grade level for each module according to Table 6. For each codeword, select the minimum grade for *MARGIN* of all modules in the codeword. Since codewords which are misdecoded are given grade level of 0, Reflectance Margin differs from Modulation, see 7.8.4.1.

The cumulative number of codewords achieving each grade shall be counted and compared with the error correction capacity of the symbol as follows:

For each grade level, assuming that all codewords not achieving that grade or a higher grade are errors, derive a notional Unused Error Correction grade as described in 7.8.8. Take the lower of the grade level and the notional UEC grade.

NOTE This notional grade is not related to, and does not affect, the *UEC* grade for the symbol as calculated according to 7.8.8, but is a means of compensating for the extent to which error correction can mask imperfections in a symbol. If one symbol has higher error correction capacity than another symbol, then the former symbol can tolerate a greater number of codewords with low modulation than the latter. See Annex F for a fuller description of the approach.

Then the Reflectance Margin grade for the symbol shall be the highest of the resulting values for all grade levels.

Table **7(B)** shows an example of grading Reflectance Margin in a symbol containing 120 codewords, 60 of which are error correction codewords with a capacity to correct up to 30 errors in a single error correction block. The Modulation grade of the symbol in the example would be 1 (the highest value in the right-hand column).

Table 7(B)— Example of Reflectance Margin grading in a two-dimensional matrix symbol, applying overlay procedure in Annex F

***MARGIN* codeword grade level (a)**	**No. of codewords at level a**	**Cumulative no. of codewords at level a or higher (b)**	**Remaining codewords (treated as errors) (120 - b) (c)**	**Notional unused error correction capacity (30 - c)**	**Notional *UEC* (%)**	**Notional *UEC* grade (d)**	**Lower of a or d (e)**
4	15	15	105	(exceeded)	<0	0	0
3	70	85	35	(exceeded)	<0	0	0
2	15	100	20	10	33,3%	1	**1**
1	5	105	15	15	50%	3	**1**
0	15	120	0	30	100%	4	0
					Reflectance Margin grade (Highest value of **e**):		1

This example represents values from the same symbol used in Table 7(A). However, in this example ten codewords from level 4, and five codewords from level 3 are detected to contain at least one module which is on the wrong side of the global threshold and are therefore errors. These codewords are therefore counted at level 0 in this example. The resulting grade too is changed significantly.

7.8.5 Fixed Pattern Damage

This parameter tests that damage to the finder pattern, quiet zone, timing, navigation and other fixed patterns in a symbol does not reduce unacceptably the ability of the reference decode algorithm to locate and identify the symbol within the field of view, by inverting the apparent state of one or more modules from light to dark or vice versa. The particular patterns to be considered, and the amounts of damage corresponding to the various grade thresholds, require to be specified independently for the symbology concerned.

Fixed Pattern Damage is evaluated in the reference grey-scale image in terms of the number of module errors (i.e. modules that appear as the inverse of the intended colour) in the feature (or part of the feature) concerned. Where the symbol comprises a number of distinct features (e.g. finder pattern, timing pattern) each feature may require to be evaluated separately and the worst value used for grading purposes.

Fixed Pattern Damage shall be graded using the threshold values appropriate to each symbology, specified in Annex A, or in the symbology specification, the latter taking precedence.

7.8.6 Axial Nonuniformity

Two-dimensional matrix symbols include data fields of modules nominally lying in a regular polygonal grid, and any reference decode algorithm must adaptively map the centre positions of those modules to extract the data. Axial Nonuniformity measures and grades the spacing of the mapping centres, i.e. the sampling points, or intersections of the grid obtained by applying the reference decode algorithm to the binarised image, in the direction of each of the grid's major axes. Axial Nonuniformity tests for uneven scaling of the symbol which would hinder readability at some non-normal viewing angles more than at others.

The spacings between adjacent sampling points are independently sorted for each polygonal axis, then the average spacings X_{AVG}, Y_{AVG}, … along each axis are computed. Axial Nonuniformity is a measure of how much the sampling point spacing differs from one axis to another, namely:

$$AN = \text{abs}(X_{AVG} - Y_{AVG}) / ((X_{AVG} + Y_{AVG}) / 2)$$

where abs() yields the absolute value. If a symbology has more than two major axes, then Axial Nonuniformity is computed for those two average spacings which differ the most.

Axial Nonuniformity shall be graded as shown in Table 8.

Table 8 — Axial Nonuniformity grading

Axial Nonuniformity	Grade
≤ 0,06	4
≤ 0,08	3
≤ 0,10	2
≤ 0,12	1
> 0,12	0

7.8.7 Grid Nonuniformity

Grid Nonuniformity measures and grades the largest vector deviation of the grid intersections, determined by the reference decode algorithm from the binarised image of a given symbol, from their ideal theoretical position.

Using the reference decode algorithm for the symbology, plot the positions of all grid intersections in the data area of the symbol and compare these positions with the ideal grid in a theoretical perfect symbol of the same nominal dimensions. The greatest distance between the actual and the theoretical position of any intersection, expressed as a fraction of the *X* dimension of the symbol, shall be taken for grading purposes.

The theoretical grid shall be constructed by equal spacing from the minimum number of reference points defined by the reference decode algorithm from the fixed patterns in the symbol.

Grid Nonuniformity shall be graded as shown in Table 9.

Table 9 — Grid Nonuniformity grading

Grid Nonuniformity	Grade
≤ 0,38	4
≤ 0,50	3
≤ 0,63	2
≤ 0,75	1
> 0,75	0

7.8.8 Unused error correction

The Unused Error Correction parameter tests the extent to which regional or spot damage in the symbol has eroded the reading safety margin that error correction provides.

Decode the binarised image using the reference decode algorithm.

The amount of Unused Error Correction is calculated as $UEC = 1,0 - ((e + 2t) / E_{cap})$, where e = the number of erasures, t = the number of errors and E_{cap} = the error correction capacity of the symbol (the number of error correction codewords minus the number of error correction codewords reserved for error detection). If no error correction has been applied to the symbol, and if the symbol decodes, the value of *UEC* is taken as 1. If $(e + 2t)$ is greater than E_{cap}, $UEC = 0$. In symbols with more than one (e.g. interleaved) error correction block, *UEC* shall be calculated for each block independently and the lowest value shall be used for grading purposes.

Unused Error Correction shall be graded as shown in Table 10.

Table 10 — Unused Error Correction grading

UEC	Grade
≥ 0,62	4
≥ 0,50	3
≥ 0,37	2
≥ 0,25	1
< 0,25	0

7.8.9 Additional grading parameters

Symbology or application specifications may define additional parameters which may be graded and taken into account in the calculation of the overall symbol grade.

NOTE For example, an application specification may require that the *X* dimension is within a certain range.

7.9 Scan grading

The scan grade for each scan shall be the lowest grade of any parameter in that scan as measured in accordance with 7.8.2 to 7.8.9.

In order to determine the causes of poor quality grades, it is necessary to examine the grades for each parameter in the scan in question as described in Annex C.

Table 11 summarises the test parameters and grade levels.

Table 11 — Test parameters and values

Parameter Grade	Decode	Symbol Contrast	Fixed Pattern Damage	Axial Non-uniformity	Grid Non-uniformity	Modulation and Reflectance Margin (interim values)	Unused Error Correction
4 (A)	Passes	$SC \geq 0{,}70$	See symbology specification or Annex A for grade thresholds	$AN \leq 0{,}06$	$GN \leq 0{,}38$	See 7.8.4	$UEC \geq 0{,}62$
3 (B)		$SC \geq 0{,}55$		$AN \leq 0{,}08$	$GN \leq 0{,}50$		$UEC \geq 0{,}50$
2 (C)		$SC \geq 0{,}40$		$AN \leq 0{,}10$	$GN \leq 0{,}63$		$UEC \geq 0{,}37$
1 (D)		$SC \geq 0{,}20$		$AN \leq 0{,}12$	$GN \leq 0{,}75$		$UEC \geq 0{,}25$
0 (F)	Fails	$SC < 0{,}20$		$AN > 0{,}12$	$GN > 0{,}75$		$UEC < 0{,}25$

7.10 Overall Symbol Grade

If incorrect data is obtained, then the overall symbol grade, irrespective of the other parameter grades, shall be 0. Otherwise, the overall symbol grade shall be the lowest of the individual parameter grades. Overall symbol grades shall be expressed on a numeric scale ranging in descending order of quality from 4,0 to 0,0.

NOTE The overall grade may be expressed as a real number to one decimal place in keeping with historical precedent.

7.11 Print growth

Print Growth tests that the graphical features comprising the symbol have not grown or shrunk from nominal so much as to hinder readability with less favourable imaging conditions than the test condition. The print growth parameter, the extent to which dark or light markings appropriately fill their module boundaries, is an important indication of process quality which affects reading performance. Print growth may be measured and evaluated independently in more than one axis, to determine, for example, both horizontal and vertical growth. Print growth shall not be a graded parameter but should be reported as an informative measure for the purposes of process control.

Starting with the binarised image, identify the graphical structures particular to the symbology that are most indicative of element growth or shrinkage in each axis of the symbol, which will generally be fixed structures or isolated elements. Based on the symbology specification and its reference decode algorithm, determine for each of these structures, in each axis, its nominal dimension D_{NOM} in modules.

Determine the actual dimension D in terms of X between the two edges of the structure by counting pixels along the grid lines derived by the use of the reference decode algorithm and passing through each structure to be measured in the symbol axis in question.

In each scan of the symbol, print growth shall then be calculated for each axis as the arithmetic mean of all values of ($D - D_{NOM}$). It shall be reported as the arithmetic mean of the values of print growth for each scan. Where the result is negative, it represents print loss.

8 Measurement methodologies for composite symbologies

Each component shall be measured and graded separately. The linear component shall be measured and graded in accordance with ISO/IEC 15416. When the two-dimensional composite component uses a multi-row bar code symbology, then the methodology specified in Clause 6 shall be applied to the two-dimensional composite component; when it uses a two-dimensional matrix symbology, then the methodology specified in Clause 7 shall be applied to it. Both the overall grade for the linear component so measured and the overall

grade for the two-dimensional composite component shall be reported, to assist users who may only require to read the linear component as well as those requiring to read the complete symbol.

9 Substrate characteristics

Certain characteristics of the substrate, notably gloss, low opacity and the presence of an over-laminate in the case of symbols printed on paper or similar media, and the surface texture and its response to the marking methods used, in the case of symbols directly marked on to the surface of an item, may affect reflectance measurements, and the recommendations in Annex E should be taken into account if any of these factors is present.

Annex A
(normative)

Symbology-specific parameters and values for symbol grading

A.1 Application

Because of differences in symbology structures and reference decode algorithms, the specific grading rules to apply to each symbology (especially with respect to fixed pattern damage) must be defined and specified for each particular symbology, either in this International Standard or within the Symbology Specification for that particular symbology.

This annex defines values corresponding to grade thresholds for Fixed Pattern Damage for Maxicode (ISO/IEC 16023). The first edition publication of this international standard also defined the fixed pattern damage grading parameters for Data Matrix and QR Code but these definitions are now included in the symbology specifications.

Where a symbology specification specifies the basis for grading these parameters, and makes express reference to this International Standard, the basis or values in the symbology specification shall override those indicated in this Annex.

Some symbologies may require additional parameters. These shall be added to the quality assessment of this standard in accordance with 7.8.9.

A.2 Data Matrix Fixed Pattern Damage

Data Matrix Fixed Pattern Damage (FPD) shall be assessed in accordance with ISO/IEC 16022.

NOTE The original version of this International Standard contained details of fixed pattern grading for Data Matrix. Such details are now found in ISO/IEC 16022.

A.3 Maxicode Fixed Pattern Damage

A.3.1 Features to be assessed

The Fixed Patterns of a Maxicode symbol are (a) a 3-ring circular bullseye near the centre of the symbol and (b) six 3-module orientation patterns surrounding it. These are shown in Figure A.1.

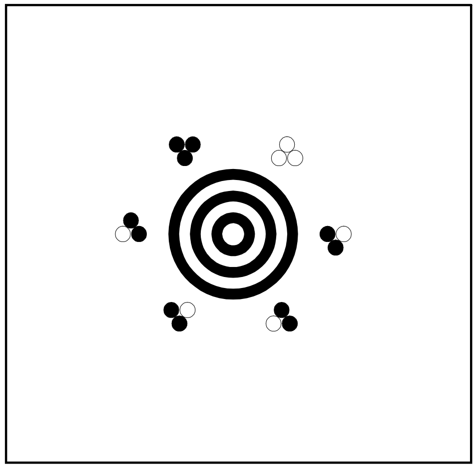


Figure A.1 — Fixed Patterns within a Maxicode symbol

A.3.2 Grading of bullseye

The bullseye is not a natural extension of the hexagonal array of data modules, and thus cannot be graded by sampling module centres. Instead, two other quality measures are performed.

1. Ring Continuity. Each of the three dark rings in the bullseye, and the two intervening light rings, shall be sampled at every image pixel location along a circular path nominally centred within the region, as shown by dotted lines in Figure A.2 below. The central light circular region shall also be sampled along a small circular path whose radius is one third the nominal radius of that region, as also shown.

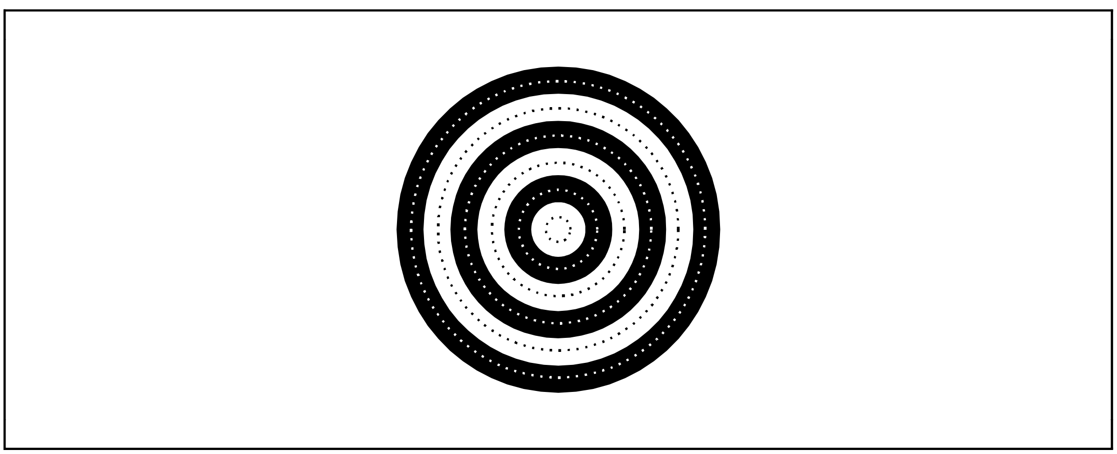


Figure A.2 — Sampling Paths within a Maxicode bullseye

These six groups of sampled points are each graded according to how many samples from along each path are the wrong colour, as a percentage of the total number of samples along that circular path, with the grade assigned as follows:

Table A.1 — Grading of Ring Continuity

Number of samples in error	Grade
0	4
≤ 3%	3
≤ 6%	2
≤ 9%	1
> 9%	0

2. Ring Growth. Scan profiles shall be measured from the grey-scale image along both horizontal and vertical scan paths (relative to the symbol's orientation) through the bullseye's exact centre as shown below, and the edge positions established by the methods in ISO 15416.

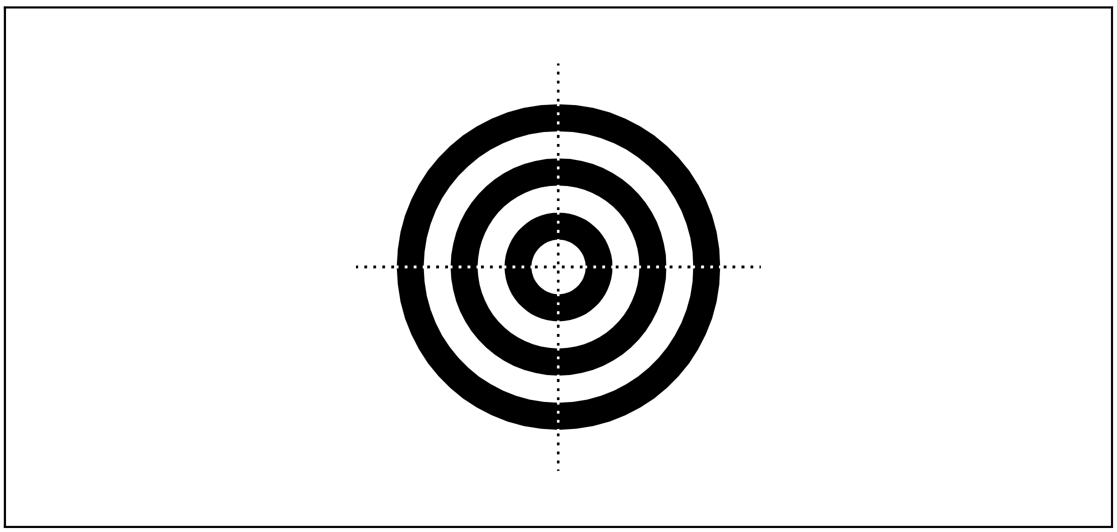


Figure A.3 — Ring Growth Sampling Paths within a Maxicode bullseye

For each profile independently, the ring growth shall be calculated as:

$$RG = (S_{bar} - S_{space}) / (S_{bar} + S_{space})$$

where S_{bar} is the sum of the bar widths

S_{space} is the sum of the space widths

excluding both of the outermost bars (the outer dark ring) and the central space (circle). These horizontal & vertical Ring Growth measurements are then each graded as:

Table A.2 — Grading of Ring Growth

RG	Grade
-0,10 < *RG* < +0,10	4
-0,14 < *RG* < +0,14	3
-0,17 < *RG* < +0,17	2
-0,20 < *RG* < +0,20	1
RG < -0,20 or *RG* > +0,20	0

A.3.3 Grading of Orientation Patterns

The six orientation patterns are taken collectively as a group of 18 modules sampled as part of the data field. Grading is performed based on a count of the number of erroneous (wrong colour) modules as follows:

Table A.3 — Grading of Orientation Patterns

Number of module errors	Grade
0	4
1	3
2	2
3	1
≥ 4	0

A.3.4 Overall Fixed Pattern Damage grade

The overall Fixed Pattern Damage grade is the lowest of the six Ring Continuity grades, the two Ring Growth grades, and the single Orientation Pattern grade achieved.

A.4 QR Code Fixed Pattern Damage and additional parameters

QR Code Fixed Pattern Damage (FPD) and additional parameters shall be assessed in accordance with ISO/IEC 18004.

NOTE The original version of this International Standard contained details of fixed pattern grading for QR Code. Such details are now found in ISO/IEC 18004.

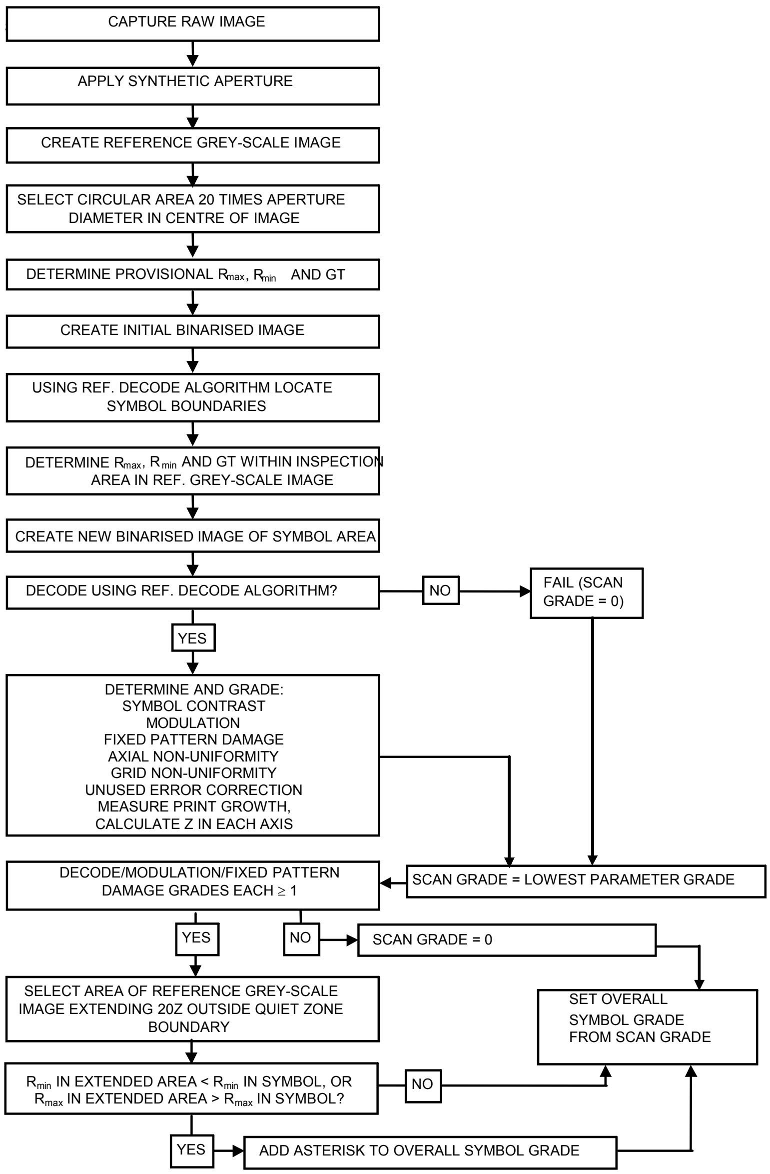
A.5 Aztec Code Fixed Pattern Damage and additional parameters

Aztec Code Fixed Pattern Damage (FPD) and additional parameters shall be assessed in accordance with ISO/IEC 24778.

Annex B
(informative)

Symbol grading flowchart for two-dimensional matrix symbols

This Annex shows the sequence of steps required in order to grade the quality of a two-dimensional matrix symbol.



Annex C
(informative)

Interpreting the scan and symbol grades

This Annex describes possible causes of reduced grades, either in a multi-row symbol or a matrix symbol.

The table below identifies a number of factors that may lead to low or failing grades for the parameters indicated, which may be similar or differ for the two classes of two-dimensional symbol.

Table C.1 — Possible causes of low grades

Parameter	Multi-row symbols	Matrix symbols

Symbol Contrast	• low background or light module reflectance, due to:
	  • incorrect substrate e.g. blue paper for red light
	  • glossy laminate/overwrap
	  • inappropriate angle of illumination (direct marked symbols)
	• high dark module reflectance, due to
	  • low absorption of incident light by ink (unsuitable formulation/colour)
	  • insufficient ink coverage (e.g. non-overlapping ink-jet dots)
	  • inappropriate angle of illumination (direct marked symbols)
		• low background or light module reflectance, due to:
		  • incorrect substrate e.g. blue paper for red light
		  • glossy laminate/overwrap
		  • inappropriate angle of illumination (direct marked symbols)
		• high dark module reflectance, due to
		  • low absorption of incident light by ink (unsuitable formulation/colour)
		  • insufficient ink coverage (e.g. non-overlapping ink-jet dots)
		• inappropriate angle of illumination (direct marked symbols)

Decode	• many factors - see other parameters in table • software errors in printing system	• many factors - see other parameters in table • software errors in printing system
Unused Error Correction	• physical damage (scuffing, tearing, obliteration) • bit errors due to defects • excessive print growth in one or two axes • local deformation • misplaced modules	• physical damage (scuffing, tearing, obliteration) • bit errors due to defects • excessive print growth in one or two axes • local deformation • misplaced modules
Minimum Reflectance (R_{min})	• Reflectance of all bars > 0,5R_{max} - see symbol contrast for possible causes	
Minimum Edge Contrast	• excessive print growth/loss • too large measuring aperture • irregular substrate reflectance • low ink coverage • showthrough	
Modulation	• print growth/loss • too large measuring aperture • irregular substrate reflectance • variation in ink coverage • showthrough	• print growth or loss • too large measuring aperture • misplaced modules • defects (spots or voids) • irregular substrate reflectance • variation in ink coverage • showthrough
Defects	• spots of ink or other dark marks on background • voids in printed areas • faulty print head elements • too small measuring aperture	

Parameter	Multi-row symbols	Matrix symbols
Decodability	• local distortion • pixel errors in printing • slippage during printing • blocked inkjet nozzle • faulty thermal element	
Codeword Yield	• excessive tilt of scan line • *Y* axis print growth • thermal "drag"	
Fixed Pattern Damage		• blocked printer nozzle • faulty thermal element • physical damage (tearing, scuffing, obliteration)
Axial Nonuniformity		• mismatch of transport speed in printing with symbol dimensions • printing software errors • verifier axis not perpendicular to symbol plane
Grid Nonuniformity		• transport errors in printing (acceleration/deceleration, vibration, slippage) • variation in printhead to substrate distance • verifier axis not perpendicular to symbol plane
Print Growth/Loss (ungraded)	• print process-dependent factors • absorbency of substrate • dot size (ink-jet, dot peening etc.) • incorrect thermal print head temperature	• print process-dependent factors • absorbency of substrate • dot size (ink-jet, dot peening etc.) • incorrect thermal print head temperature

Annex D
(informative)

Guidance on selection of grading parameters in application specifications

D.1 Selection of measurement wavelength

D.1.1 General considerations

Clauses 6 and 7 of this standard require measurements to be made using light of the same characteristics as those which the intended scanning environment will use. If, as may happen, an application specification does not specify the light source, a judgment must be made in order to determine the most probable light source for reading, to enable valid measurements to be made and to be sure that the results will be properly indicative of likely scanning performance in the application.

It should be noted that for maximum correlation, it is not only the light source (including any filters that modify its spectral distribution) that must be taken into account, but also the spectral sensitivity of the sensor, since reflectance at a given wavelength is a function of the product of the intensity of the light emitted and the sensitivity of the sensor. However for the purposes of this Annex, the sensor sensitivity is ignored.

D.1.2 Light sources

Light sources for bar code scanning applications normally fall into two areas:

— narrow band illumination in either the visible or the infra-red spectrum or

— broadband illumination covering a large part of the visible spectrum, sometimes referred to as "white light" although it may have a bias to a colour; a very few specialised applications may call for light sources of unusual characteristics such as ultra-violet for fluorescent symbols.

Multi-row bar code scanning almost always uses narrow band visible light, with light sources with a peak wavelength in the red part of the spectrum, between 620 and 700 nm. Infra-red scanning uses sources with peak wavelengths between 720 nm and 940 nm.

Two-dimensional matrix symbols are scanned under a variety of illumination conditions, with the most common being white light and, in a number of hand-held reading devices, the same visible red area of the spectrum as for linear and multi-row bar code symbols.

The most common light sources used for these purposes are:

a) Narrow band

1) Helium-neon laser (633 nm) (multi-row bar code symbols only)

2) Light-emitting diode (near-monochromatic, at numerous visible and infra-red peak wavelengths)

3) Solid-state laser diode (most usually 660 nm and 670 nm) (multi-row bar code symbols only)

b) Broadband

1) Incandescent lamp (nominally white light with a colour temperature in the range 2800°K to 3200°K)

2) Fluorescent lighting (nominally white light with a colour temperature in the range of 3200°K to 5500°K)

3) Light-emitting diode (nominally white light with a colour temperature in the region of 7000°K)

4) Halogen lamps (nominally white light with a colour temperature in the region of 2800°K to 3200°K)

5) Gas discharge lamps (light of various characteristics)

The key characteristics of these are as follows.

A **helium-neon laser** is a gas-filled laser tube which emits highly monochromatic coherent light at a peak wavelength of 632,8 nm (usually rounded to 633 nm), in the visible red area of the spectrum.

A **light-emitting diode** is a low-power solid-state component most frequently found as the light source in a light pen (wand) or CCD scanner. Operating wavelengths in the visible spectrum may be from 620 to 680 nm; most commonly either 633/640 or about 660 nm. In the infra-red spectrum, 880 to 940 nm is the most common range of wavelengths.

A **laser diode** is also a low power solid-state component emitting highly monochromatic coherent light. Typical wavelengths in the visible spectrum used by these, at the date of publication of this standard, are 660 and 670 nm. In the infra-red spectrum 780 nm is common. They are frequently found in hand-held (laser) scanning equipment and a number of fixed scanners.

Broadband light sources are mainly found in systems using two-dimensional imaging and image processing technology rather than scanning techniques.

Incandescent lamps have a power distribution covering much of the visible spectrum and well into the near infra-red spectrum; their optical characteristics are more easily defined in colour temperature terms rather than in those of peak wavelength, because of the wide bandwidth and relative absence of clearly-defined peaks in the power distribution. These broadband power distribution characteristics mean that the symbol contrast values obtained from symbols may vary with different colour temperatures to a significantly lesser extent than values obtained with light sources whose power distributions peak sharply with narrow bandwidth.

Halogen lamps (also known, more correctly, as tungsten halogen lamps) are a development of incandescent lamps with a higher colour temperature and a smooth power distribution curve across the spectrum, extending well into the near infra-red.

Fluorescent light sources also produce nominally white light and have broadband power distribution characteristics, which, in comparison with those of an incandescent source, tend more towards the bluer region of the visible spectrum, often with a significant ultra-violet component, and a number of peaks in their spectral power distribution. Typical colour temperatures for such lighting are in the region of 3200° to 5500°K. The physical structure of a fluorescent lamp is that of a tube which can be formed into various shapes, and an annular shape concentric with the optical axis of a reading device provides very satisfactory uniform diffuse illumination.

Light emitting diodes with nominally "white light" characteristics emit "cool" white light and may have a nominal colour temperature in the region of 7000°K. Their actual spectral distribution may show a number of peaks e.g. in the blue and yellow or orange regions.

Gas discharge lamps tend to have spectral distributions with multiple sharp peaks at wavelengths depending on the precise mixture of gases used. For example, sodium vapour emits light with a well-defined peak at around 580 nm (yellow-orange) and mercury vapour emits a green-blue light at around 520 nm.

The use of filters to modify the spectral distribution of the illumination system is common. For example, when used in conjunction with a Wratten 26 filter, the light characteristics of a 2856°K lamp approximate to those of a 620-633 nm source. The use of infra-red and/or ultra-violet absorbing filters is also common in scanning systems. It is possible to alter the apparent colour temperature of a source by the use of filters.

NOTE: Wavelengths and colour temperatures stated above are indicative and may change as the technology evolves.

D.1.3 Effect of variations in wavelength

The reflectance of a substrate or bar code symbol element varies with the wavelength of the incident light. A black, blue, or green printed area will tend to absorb visible red light strongly (and appear therefore of low reflectance), whereas a white, red or orange area will reflect most of such incident light. In the infra-red spectrum, the apparent colour of the element does not correlate at all with reflectance; it is the nature of the pigmentation used (for example the proportion of carbon content) which governs reflectance. Taking reflectance measured at 633 nm as a reference, when measured at 660 or 680 nm the results may differ significantly, and sufficiently to cause the symbol grade to change by one or two units, or even more in the case of bars printed on some thermal papers.

In the case of broadband illumination, however, the presence of light at multiple wavelengths in the spectral power distribution of the light means that reflectance values of black inks measured under white light from various sources will not differ significantly; there may however be some variation (an increase in reflectance) in the case of dye-based black inks where the illumination has a significant infra-red component. With coloured pigments there will be greater variations. Interposing a filter in the light path will introduce a more peaked spectral distribution and the spectral response curve of the reader will require to be more closely matched to that of the light source. It is not uncommon for the optical train to include both infra-red and ultra-violet absorbing filters.

D.1.4 Considerations affecting selection of broadband light sources

Broadband light sources, by definition, emit light over a band of wavelengths without a clearly defined sharp peak. Nonetheless, the intensity of light emitted at different wavelengths will vary. In particular, light of a colour temperature in the region of 3000°K is described as "warm" light and the spectral distribution of this light shows higher intensity of emission towards the red (and infra-red) region of the spectrum, whereas light with a higher colour temperature in the region of 6500°K is described as "cool" light and its spectral distribution is biased to the blue-violet region of the spectrum, extending into the ultra-violet. Light with a higher colour temperature will yield higher reflectance values on blue pigments than light with a lower colour temperature. The converse is true for red pigments.

It is possible to modify the apparent colour temperature of a light source by the interposition of an appropriate filter.

It may also be possible to approximate the characteristics of different broadband light sources with sufficient precision for bar code symbol quality assessment purposes by combining reflectance measurements at three narrow band wavelengths across the visible spectrum, e.g. in the red, green and blue regions (assuming that the ultra-violet and infra-red regions have been cut off by the use of appropriate absorbing filters); the results can then be modified to match the spectral response characteristics in the application by applying an appropriate correction factor at each wavelength.

D.2 Selection of aperture

For matrix symbol grading, the choice of aperture size is very important, and it must be specified in accordance with 7.3.3 in order for symbol grades to be measured consistently. It is the responsibility of an application specification to define a fixed measuring aperture to be used. As required by 5.4 of this standard, the aperture size must be reported together with the grade and illumination in order to identify the conditions under which the measurement was made.

The size of the measuring aperture affects whether voids in the symbol will be “filled in” during the verification process. Therefore, the measuring aperture must be selected with reference to the range of nominal module size and expected scanning environment. An aperture that is too small will not fill in unintentional voids, or gaps between elements of a direct marked symbol, that would lead to low grades or undecodable symbols. On the other hand, a measuring aperture that is too large will blur individual modules, resulting in low modulation, and may prevent the symbol from being decoded.

An aperture size in the range of 50% to 80% of the minimum allowed module size is a typical choice for an application specification. Importantly however, an application specification that allows a range of nominal

module sizes (for example a range of 0,25 mm through 0,40 mm) should specify a single aperture size to be used in all cases. That is to say that the verification of each symbol is made with an aperture that is not necessarily related to that symbol's module size. For example if 80% of 0,25 mm were specified, i.e. a 0,20 mm aperture, then all symbols used in that application including 0.40 mm symbols must be measured using a 0,20 mm aperture. Another aperture size may be chosen, even one equal to or larger than the minimum module size. The important factor is that a single measuring aperture be specified and used consistently within an application area.

If a range of module sizes is used within an application specification, then the relatively small measuring aperture required to read the symbols with the smallest module size will limit the size of the largest acceptable spots and voids. If too large an aperture were used, the modulation for the smallest module size would be inadequate. In general the larger the aperture, the larger the acceptable size of spots and voids. Conversely, the smaller the aperture, the smaller the acceptable module size that can be read. Therefore, a successful application specification must select a measuring aperture that will predict the readability of both the largest and smallest module size symbols.

A single fixed measuring aperture ensures that all symbols will be measured in a way that will reflect performance in the expected scanning environment. The choice of measuring aperture that is specified will be influenced in some cases by the scanning equipment that is expected to be prevalent in the application-scanning environment. Conversely, the scanning equipment may also be influenced by the specification of the measuring aperture. In both cases however, a "match" between verification technique and scanning environment is made in order to produce a high correlation between grade level and scanning performance.

The nominal diameter of the measuring aperture should be specified by the user application specification, to suit the intended scanning environment or with reference to the guidelines of Table D.1 . When the measuring aperture diameter is not specified in the application specification, Table D.1 should be used as a guide. In an application where a range of X dimensions will be encountered, all measurements shall be made with the aperture appropriate to the smallest X dimension to be encountered.

NOTE An application specification may specify a range of X dimensions that differs from those listed in Table D.2 and can specify an aperture size that differs from the recommendation of Table D.2.

Table D.1 — Guideline for diameter of measuring aperture

X Dimension(mm)	Aperture diameter (mm)	Reference number
0,100 ≤ X < 0,150 (4mil-6mil)	0,050	02
0,150 ≤ X < 0,190 (6mil-7.5mil)	0,075	03
0,190 ≤ X < 0,250 (7.5mil-10mil)	0,125	05
0,250 ≤ X < 0,500 (10mil-20.0mil)	0,200	08
0,500 ≤ X < 0,750 (20mil-30mil)	0,400	16
0,750 ≤ X (30mil-)	0,500	20
NOTE The aperture reference number approximates to the measuring aperture diameter in thousandths of an inch; this reference number is used for consistency with the ANSI standard X3.182 and ISO/IEC 15416.		

D.3 Selection of lighting angle

Whereas the default 45° illumination angle is well suited to printed symbols and those marked on even surfaces without localised points of specular reflection, i.e. those from which diffuse reflection does not vary sharply with the angle of incidence or collection of the light, many "direct marked" symbols require to have the angle of incidence adjusted to optimise reading performance. The spectral characteristics of the illumination for use with engraved or similar symbols may therefore be less important than the respective angles of incidence and collection of the light on the symbol. The light source needs to be positioned in such a way that the apparent contrast as seen by the image capture device is related to the process used in the application to read the symbols.

Depending on the nature of the surface and the marking technique used, the spectral characteristics of the light source may also have an influence on its contrast. Prediction of scanner performance will be enhanced when the application specification requires verification using the same source as that used for reading the symbols. The modified version of the methodology defined in ISO/IEC TR 29158 may provide a better approach to select appropriate lighting angles for direct part marks.

D.4 Selection of minimum acceptable grade

The specification of the minimum acceptable grade in an application specification should be based on consideration of the trade-off between the possibly increased cost of producing higher-grade symbols and the improved scanning performance to be obtained by the use of such symbols, together with the data integrity requirements of the application.

A requirement for higher grade symbols may restrict the choice of the following available to the producer of the symbols:

— Inks (or other marking media) and substrates on which to mark the symbol (e.g. to ensure a high level of symbol contrast, a substrate with high reflectance and/or an ink with low reflectance under the specified illumination are needed, imposing limits on the choice of colour available)

— Marking technology (e.g. those in which the placement of printer dots is less well-controlled may be excluded)

It may also require slower production rates or higher levels of quality control, or lead to higher rejection rates, all of which contribute to higher unit costs.

On the other hand, the receiver of the symbols will benefit from improved read rates, or may have a greater choice of reading technology open to him.

If a low symbol grade is specified, the receiver of the symbols may incur additional costs in:

— Installing higher quality reading equipment

— Accepting a lower read rate

— Reprocessing of symbols that failed to scan.

Many applications require a minimum grade of 1,5 (C), which offers them a fair balance between the cost of production and reading performance under the conditions of their application.

The more critical it is that a high read rate be achieved, on grounds not only of cost but also data integrity, the higher the grade that needs to be specified.

D.5 Affect of Symbol Rotation during verification

The first edition publication of this international standard called for an overall grade to be computed by averaging five individual scan results, taken with the symbol rotated in five different orientations. However, this requirement has been removed and this standard now calls for only one scan to be used for grading.

The five scan rotation requirement was originally required for two reasons: to account for symbols that do not exhibit uniform diffuse reflection and to “average out” any effective changes in measurement resolution by verification devices. The first reason is better addressed through a modified version of the methodology defined in this international standard in ISO/IEC TR 29158. The second reason is addressed by the publication of ISO/IEC 15426-2 which requires the minimum effective resolution defined in 7.3.3.

The removal of the five rotation requirement greatly simplifies the verification procedure for most symbols (whose characteristics do not vary with orientation) and facilitates practical quality control regimes.

Annex E
(informative)

Substrate characteristics

E.1 Rationale

In certain circumstances for example, the design and production of printed packaging materials incorporating bar code symbols or the production of symbols directly marked on to a surface, it may be necessary or desirable to assess the acceptability of substrates and/or ink colours for a given bar code application, before a bar code symbol is available which could be tested in accordance with this standard. Reference should be made to ISO/IEC TR 19782 for additional guidance on the effects of gloss and low substrate opacity on the reading and verification of these symbols.

E.2 Substrate opacity

The methodology of the International Standard requires that the symbol shall be graded according to the parameters in Clause 6 (multi-row symbols) or 7 (matrix symbols) when measured in its final configuration, e.g. final filled package.

If it is not possible to measure the symbol in this configuration then the effects of show-through of high-contrast interfering patterns may be ignored if when measured as follows the substrate opacity is 0,85 or greater. If the opacity is less than 0,85 the symbol should be measured when backed by a uniform dark surface the reflectance of which is not more than 5 per cent.

The opacity of the substrate shall be calculated as follows:

$$\text{Opacity} = R2 / R1$$

where: $R1$ = Reflectance of a sample sheet of the substrate backed with a white surface the reflectance of which is 89 percent or greater.

$R2$ = Reflectance of the same sample sheet backed with a black surface the reflectance of which is not more than 5 percent.

E.3 Gloss

The reference illumination conditions specified for the measurement of reflectance should enable the maximum rejection of specular reflection while giving a representative assessment of the diffuse reflectance of the symbol and substrate. Highly glossy materials and those whose diffuse reflectance characteristics vary with the angle of incident and/or collected light - as may be the case with many materials on which symbols are directly marked - may yield grades differing from those obtained by the use of the reference optical arrangement with illumination at 45°, and for this reason sub-clause 7.3.4 provides alternative angles of illumination to enable apparent symbol contrast to be maximised.

E.4 Over-laminate

A symbol intended to be covered with a protective lamination should be graded according to the parameters in clause 6 (multi-row symbols) or Clause 7 (matrix symbols) when measured with the laminate in place. The thickness of the laminate including its adhesive should be as small as possible in order to minimise its effects on the reading performance of the symbol.

E.5 Static reflectance measurements

E.5.1 General

In some cases it may be desirable to carry out static reflectance measurements of samples of the substrate on which a bar code is to be printed and on colour patches or ink samples which replicate the colour in which the bar code will be printed. The following guidelines provide a means which, if it is followed, will predict as closely as is generally possible the results which will be obtained when the symbol is scanned dynamically.

Static reflectance measurements should be made with the wavelength of light, aperture size and optical arrangement which relate to the application and which are specified in accordance with ISO/IEC 15416 (multi-row symbols) of this standard.

Where reflectance measurement equipment meeting the requirements of this Annex is not available, optical density measurements may be made using a standard densitometer with an appropriate light source and converted to reflectance values; density (D) and reflectance (R) are related as follows:

$$R = 100 / 10^D$$

NOTE It is impossible to predict to a high degree of accuracy the symbol contrast and, in particular, the edge contrast which will be achieved in the printed symbol. It is therefore appropriate to allow some safety margin above the minimum values for specified grades.

E.5.2 Prediction of Symbol Contrast (*SC*)

The prediction of *SC* requires that measurements of reflectance be made on samples which simulate the highest (R_{max}) and lowest reflectance (R_{min}) areas which will be present in the finished symbol.

It is probable that in most bar code symbols R_{max} will be found in the quiet zone of the symbol; therefore to simulate the conditions found in the quiet zone, R_{max} should be measured in the centre of a sample area, at least 10X in diameter, of the material on which the symbol is to be printed.

It is probable that in most bar code symbols R_{min} will be found in the widest bars of the symbol, or areas with a number of contiguous dark modules; therefore to simulate the conditions most likely to yield a value of R_{min} consistent with that which would be found in practice, reflectance should be measured in the centre of a strip of material 2X to 3X wide and which matches the colour in which the dark elements are to be printed.

A predicted value of *SC* can then be calculated:

$$SC' = R_{max} - R_{min}$$

For materials which do not satisfy the tests for opacity, which are detailed in Annex E.1, the measurements which are made for the purpose of predicting *SC* should be made with the test samples backed by a uniform dark surface, the reflectance of which is not more than 5%. The same measurements should then be made with the test samples backed by a uniform surface the reflectance of which is not less than 89%. The calculated value of static SC shall be equal to or greater than the minimum value for the grade selected for the application, for tests on both the dark and light backgrounds.

Annex F
(informative)

Parameter grade overlay applied to two-dimensional symbologies

This Annex describes the technique used in this International Standard to derive a final grade for a parameter from a set of notional grades determined for a set of grade levels, each determined at five fixed grade levels for the parameter.

The technique computes a notional grade for a parameter for each grade level by assuming that only modules or codewords that meet or exceed that grade level for that parameter are actually readable. The modules or codewords which are readable then result in a grade for that parameter according to the rules for that parameter (whether based on unused error correction or fixed pattern damage).

If one considers what the performance would be for a scanner that could only read codewords or modules above a particular parameter grade level, it is clear what will happen – only codewords or modules at or above that grade level may be counted towards the readability calculation for the symbol at that grade level.

For example, if codewords or modules with a grade of 2 must be counted before a grade of 3 on unused error correction or fixed pattern damage may be obtained, then the symbol must be a grade 2.

Furthermore, if codewords graded 3 or better can only result in an unused error correction or fixed pattern damage level of 2, the symbol must also be a grade 2.

However, the readability of a symbol must take into account the readability of codewords or modules at each grade level and the ability of the symbol to be read using error correction or allowing for some fixed pattern damage and the resulting grade should be the highest of these two possible outcomes.

The following procedure can therefore be established:

a) Count the number of codewords in each grade level, including higher grade levels, assume that all remaining codewords are erasures (multi-row symbols) or errors (matrix symbols) and determine an unused error correction or fixed pattern damage grade.

b) For each grade level, take the lower of the grade level and the associated unused error correction or fixed pattern damage parameter grade.

c) Select the highest of the values from step b as the symbol grade for that parameter.

This ensures that a scanner will have performance associated with the assigned grade because the scanner's ability to read codewords or modules of the assigned grade or higher will bring it within the error correction or fixed pattern damage capacity of the assigned grade level or better.

This method provides a way of accounting for imperfections in symbols which are designed to tolerate imperfections. In fact, it favours symbols with more error correction capacity, which certainly does make a symbol easier to read. It also reconciles the print quality measurement method of linear symbols with that of 2D symbols. In a sense the linear approach, which takes the worst case, is the trivial extension of the above rule in the case of no error correction. In this case, the codeword with lowest grade is always needed to get anything other than a 0 for "unused error correction". If this value happens to be a 1, then the symbol must be a 1, even if all other codewords had quality of 4.

NOTE The notional Unused Error Correction or Fixed Pattern Damage grade used in this calculation is not related to, and does not affect, the UEC or Fixed Pattern Damage grade for the symbol as calculated according to 6.2.4, 7.8.8 or 7.8.5 respectively.

Bibliography

Symbology specifications

Multi-Row Symbols with cross-row scanning ability

[1] ISO/IEC 15438, *Information technology — Automatic identification and data capture techniques — PDF417 bar code symbology specification*

[2] ISO/IEC 24728, *Information technology — Automatic identification and data capture techniques — MicroPDF417 bar code symbology specification*

[3] AIM ITS - SuperCode

Multi-Row Symbols without cross-row scanning ability

[4] EN 12323, AID technologies - Symbology Specifications - Code 16K

[5] ANSI/AIM BC6-1995, USS - Code 49

[6] AIM USS Codablock F

[7] ISO/IEC 24724, *Information technology — Automatic identification and data capture techniques — GS1 DataBar bar code symbology specification*

Matrix Symbols

[8] ISO/IEC 16022, *Information technology — Automatic identification and data capture techniques — Data Matrix bar code symbology specification*

[9] ISO/IEC 16023, *Information technology — International symbology specification — MaxiCode*

[10] ISO/IEC 18004, *Information technology — Automatic identification and data capture techniques — QR Code 2005 bar code symbology specification*

[11] AIM USS - Code One

[12] ISO/IEC 24778, *Information technology — Automatic identification and data capture techniques — Aztec Code bar code symbology specification*

[13] AIM USS - Dot Code A

Composite Symbologies

[14] ISO/IEC 24723, *Information technology — Automatic identification and data capture techniques — GS1 Composite bar code symbology specification*

[15] AIM ITS - Aztec Mesas

NOTE 1 Specifications published by AIM Global - viz. AIM International Technical Specifications (ITS) and Uniform Symbology Specifications (USS) - are obtainable from AIM Inc., 634 Alpha Drive, Pittsburgh, PA 15238, USA

NOTE 2 This is not an exhaustive list of symbology specifications.

Other specifications

[16] ISO 2859-10, *Sampling procedures for inspection by attributes — Part 10: Introduction to the ISO 2859 series of standards for sampling for inspection by attributes*

[17] ISO 3951-1, *Sampling procedures for inspection by variables — Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL*

[18] ISO 3951-2, *Sampling procedures for inspection by variables — Part 2: General specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection of independent quality characteristics*

[19] ISO 3951-3, *Sampling procedures for inspection by variables — Part 3: Double sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

[20] ISO 3951-5, *Sampling procedures for inspection by variables — Part 5: Sequential sampling plans indexed by acceptance quality limit (AQL) for inspection by variables (known standard deviation)*

[21] ISO/IEC 15426-1, *Information technology — Automatic identification and data capture techniques — Bar code verifier conformance specification — Part 1: Linear symbols*

[22] ISO/IEC 15426-2, *Information technology — Automatic identification and data capture techniques — Bar code verifier conformance specification — Part 2: Two-dimensional symbols*

[23] ISO/IEC TR 19782, *Information technology — Automatic identification and data capture techniques — Effects of gloss and low substrate opacity on reading of bar code symbols*

[24] ISO/IEC TR 29158, *Information technology — Automatic identification and data capture techniques — Direct Part Mark (DPM) Quality Guideline*

ICS 35.040
Price based on 43 pages

Exhibit 6

Barcode Scanning for Logistics When Social Distancing Matters

Barry J. Ewell
June 18, 2020

Handheld devices, barcode scanners and barcodes and are an integral part in Transportation and Logistics (T&L) are necessary tools for helping to move products and goods thought the supply chain. Especially in recent months we have seen incredible stress put on T&L to keep freight and ecommerce moving while adapting to social distancing and keeping their workers safe.

These devices help increase efficiency so manufactures and retailers can adequately maintain inventories, drive on-time deliveries to warehouses and doorsteps. Together devices and barcodes enable real-time visibility for operations, advanced decision-making companies, and improved order processing/fulfillment and customer services from the manufacturing to warehouse to delivery.

Warehouse workers, drivers and retail associates need devices that can withstand the demands of working conditions that push these tools to their limits with drop/tumbles/vibrations, extreme environments, and varying workflows. The devices must be dependable throughout years of shift work to instantly collect and update data accurately and securely.

Barcodes have made business more efficient for companies, providing an essential method to track and store information about millions of items. In T&L barcodes are used in

- **Manufacturing** for inventory management, work in progress, asset tracking, shipping and receiving, and compliance labeling.
- **Warehouse distribution** to automate and optimize workflow functions such as picking, put-away, stock replenishment, shipping, and receiving.
- **Transportation and logistics** to help track every item throughout the supply chain such as cross-docking, fleet management, and

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pick-up and delivery operations.

- **Postal and parcel delivery services** scan all barcoded mail pieces (flats, letters, and packages) that enter the mail stream and track those items with additional scans up to the point of delivery. Scanning accuracy is critically important to the success of real-time visibility.
- **Ecommerce** for order fulfillment, marketing efforts, packing/shipping, transportation, inventory, warehouse operations, and more.

Let's take a closer look at the importance of mobile devices and barcodes and just how they work together to keep T&L moving in a time of social distancing.

Importance of the 1D and 2D Barcodes

When most individuals think of barcodes, they picture a horizontal linear code made up of variable-width lines and spaces spread from left to right as ubiquitously seen on consumer goods. This is a 1D (one-dimensional) barcode.

The 1D barcode is the 12-digit UPC number. The first six numbers are the manufacturer identification number, the next five digits represent the item's number, and the final number is referred to as the check digit, which is used to help the scanner determine if the code was read correctly. When this information is scanned and sent to the computer database, the information can then be associated with data specific to the item such as price, number of items in stock, item description, and item image.

Unlike the 1D barcode that is read horizontally, the 2D (two-dimensional) barcode, looking like a square or rectangle, stores information both horizontally and vertically, thus it is read in two dimensions. The 2D code uses patterns of squares, hexagons, dots, and other shapes to encode data. This little shape can hold over 4,000 characters and 7,000 digits while still appearing physically smaller. An example of a 2D barcode would be a QR or Data Matrix code. A 2D barcode encodes alphanumeric information as well as images, website addresses, voice, and other types of binary data.

Feedback

Difference between 1D laser and 2D imager barcode scanners

Laser barcode scanners were the original 1D barcode scanner. The scanner directs a red beam of light toward a horizontal variable-width row of black and white lines and spaces. This beam of light is directed back and forth by a rotating mirror or prism. The light reflects off the barcode into a light-detecting electronic component called a photoelectric cell. The white areas of the barcode reflect the most light and black the least light. The scanner detects the width and sequence of black and white stripes and converts them into decimal numbers. Standard laser

scanners can read from a few inches to a few feet depending on the barcode. Extended range laser barcode scanners can read over 30 feet when using reflective labels.

The 2D imager barcode scanner functions like a digital camera. These scanners can read both 1D and 2D barcodes. Rather than using a laser, the imager barcode scanner takes a picture and uses a decoding algorithm to locate the barcode within that image and then decode the data from that barcode within that image. Unlike a laser scanner, the imager does not require the barcode to be oriented in a specific way to be read. Most barcode scanners today are camera-based. 2D imagers can read barcodes off any surface including smartphones.

Mobile Scanning Solutions for Transportation & Logistics

At Honeywell, we make barcode scanning easy for workers in Transportation & Logistics. That's why Honeywell barcode readers are plug and play with industry-leading scan performance, making even the most difficult-to-read barcodes look good. Honeywell scanners provide superior durability and reliability, with water- and dust-proof housings and rubberized to reduce damage from falls.

- **Ease of Use.** Ease of use is an important variable for how well a mobile device enhances productivity. Seconds count in high-volume operations. By saving a few seconds recording each transaction, businesses create value by producing significant time and labor savings that lower their overall cost structure.
- **Barcode Scanning**. Barcode scanning capability is an important ease-of use differentiator among devices. Smartphone cameras are capable of reading some barcodes but are not necessarily designed for the task. Not only is scanning speed a feature that should be considered, it's important to recognize the ergonomic design of a device that enables snappy scanning from different angles and devices without causing strain on the wrist, as well as the device's ability to read damaged barcodes.
- **Productivity.** Productivity will decrease and costs will go up if the mobile device does not easily support the work process. Consumer smartphones and tablets are not optimized for entering data (via keypad, touchscreen, barcode scanning, imaging or other peripherals). If those activities will be part of your enterprise mobility work process, carefully consider how convenient and ergonomic consumer devices will be for users. Some purpose-built enterprise computers have keypads and touchscreens that are intended for use by gloved operators to support more convenient and accurate data entry. Making a typo on a text to a friend has different consequences than entering the incorrect digit for quantity or part number on an order form. Screens also need to be readable in direct sunlight, another feature of enterprise-designed devices.
  Handstraps on an enterprise device should also be taken into account. They allow a field worker to carry parcels or handle other equipment at the same time as the device and often are accompanied by a stylus for signing on screen by the customer.

When coupled with buttons that allow left- or right-handed use, straps can save seconds per transaction or event and so improve productivity.

- **Solution for Social Distancing and Contactless Delivery**. Ruggedized mobile devices/consumer grade devices with enterprise level scanners are able to easily accommodate scenarios like
  - Last mile providers who use connectivity applications allowing customers to request deliveries be left at their door and be alerted by SMS or push notification.
  - Couriers can take a photo of the delivery at the customers doorstep and then email it along with the delivery notice.
  - Delivery drivers drop parcels at the doorstep, ring the doorbell, and then ask the customer to confirm their name from a safe distance.
- **Power Management.** Mobile devices designed for productivity have power management advantages that can help ensure that batteries will last the length of the shift. For remote mobile workers, device uptime is crucial because dead batteries could represent a lost day of work. Enterprise devices have more powerful batteries, which extends the working day of a device before it will need to be recharged.
- **Product Lifecycle.** Product lifecycle is the key differentiator between consumer smartphones and rugged mobile computers. Consumer devices have a much shorter timespan before they are superceded by a brand-newmodel, whereas enterprise devices are designed to provide many years of service.

Honeywell Ruggedized Mobil Computers

Feedback

Rugged mobile computers that are purpose built for enterprise operations often have built-in support for barcode reading, document scanning, speech input, mobile printer drivers and other functionality. Having these capabilities native to the device helps to future-proof it for multi-use cases.

Honeywell's has a complete line-up of rugged handheld computers on the Honeywell's Mobility Edge unified hardware and software platform. They provide multipurpose utility in an ergonomic form factor, driving improved productivity for your mobile workers and a lower total cost of ownership for your business. It allows for rapid deployments, enhanced performance, and adaptability to changing needs. With Mobility Edge, a one-time investment in setup, deployment, and provisioning is reusable across all devices.

Honeywell ruggedized devices on the Android Mobility Edge platform offers the longest lifecycle in the industry with support through seven Android releases, Android N to Android 13/T *, plus security updates for up to five years after Google's last patch which is 2030.

- Our handheld computers combine the advantages of consumer devices and high-end industrial mobile computers into a single rugged package.
- Honeywell devices are designed with the worker in mind, and they provide targeted functionality, a tactical keypad and enhanced connectivity.

- Our mobile devices have power management advantages that help ensure batteries will last the length of the shift. For remote mobile workers, device uptime is crucial — dead batteries can represent a lost day of work.
- Barcode scanning capability is another important ease-of-use differentiator. Smartphone cameras can read some barcodes but are not necessarily designed for the task.

The Mobility Edge family includes:

- **Honeywell CN80** mobile computer, an ultra-rugged device for warehouse, manufacturing, and transportation and logistics environments. The most durable handheld Honeywell has ever made, it features both keypad and large touchscreen interface for quick, efficient data entry.
- **Honeywell CT60** mobile computer, a rugged versatile business tool for highly mobile frontline workers in scan-intensive workflows in pickup and delivery, DSD, and parcel post. It offers a long-lasting battery, high-performance scanning, and exceptional durability and reliability.
- **Honeywell CT40** mobile computer, a full-touch, five-inch display device designed for retail, hospitality, and light field mobility environments. It's an intuitive, compact productivity tool optimized for hours of comfortable use.
- **Honeywell CK65** mobile computer, a rugged, flexible solution for warehouse and manufacturing environments, with both touchscreen and keypad data input options for quick data entry and enhanced scanning read ranges of up to 15.2 m (50 ft).
- **Thor VM1A**, the world's top-selling vehicle-mounted computer, upgraded to Mobility Edge. Hits the sweet spot of overall size, display size, and keypad. The Smart Dock enables use on multiple vehicles and reduces support and maintenance costs. A field-replaceable front panel minimizes downtime.
- **Thor VM3A,** designed for the toughest distribution center environments, manufacturing facilities and freight operations. In fact, it's the industry's most capable full-size vehicle-mounted mobile computer. The VM3 computer combines a 30.73 cm (12.1 in) display with breakthrough innovations that deliver rapid value for your workflows.

Feedback

Honeywell Captuvo Enterprise Sled for iOS Mobile Devices

Honeywell's Captuvo enterprise sleds For enterprises looking to extend the capabilities of their employee or corporate-owned iOS platforms, these platforms can be integrated with Honeywell's Captuvo enterprise sleds. This transforms the consumer grade smartphone into an enterprise-ready device that provides instant access to critical business information across multiple shifts while leveraging the 2D barcode scan engine built into the Captuvo sled. They come in non-healthcare and healthcare-grade disinfectant-ready housing. Key takeaways include:

- Quickly and accurately focuses, illuminates, and reads hundreds of 1D/2D barcode barcodes per shift, even when they're damaged,

poorly printed or on a mobile screen.

- Scanner minimizes the amount of time spent in the delivery outlet, thus reducing exposure to other workers and consumers.
- Protective disinfectant-ready housing that can withstand sanitization chemicals and keeps the iOS device protected from abuse such as drops, bumps, and spills common to T&L environments while providing a disinfectant-ready housing specifically designed to handle harsh cleaning agents.
- Rugged specifications extend the iOS devices lifecycle and eliminate the more frequent replacements required for consumer devices alone.
- Extends your iOS device battery life so it can last a full shift and beyond.
- Designed for quick battery replacement, so you don't lose valuable time taking care of customers.

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Feedback

Honeywell Marketplace is a worldwide showcase for the latest apps and software solutions to help you increase productivity and drive overall profitability in the DC/warehouse and T&L. All of the apps are certified to run on your fleet of Honeywell Mobility Edge family devices and/or Android-based device. The online platform enables both Honeywell and our Independent Software Vendor (ISV) partner ecosystem to meet and collaborate to deliver solutions to the industries we serve. This online marketplace provides the ability for you to find, learn about, purchase, and deploy solutions that meet your strategic needs. For example, consider the following apps from the Honeywell Marketplace

- **Vector.** Vector makes it easy for fleet operations teams to digitize documents in the field and the back office, resulting in paper elimination, reduced health and safety risks, and increased cash flow. Vector enhances existing technology investments with mobile capabilities and real-time collaboration, reducing physical interactions across logistics partners.

- **FarEye-Delivery.** FarEye's predictive logistics platform enables enterprises to orchestrate, track, and optimize their logistic operations. FarEye empowers enterprises to win in this customer-centric era with exceptional delivery experience and efficient movement of goods for both B2C and B2B segments.

- **ProntoForms.** In last mile deliveries, it's imperative to reduce contact. ProntoForms is a third-party custom app platform for easily adapting or building custom delivery workflows with no-touch delivery confirmation. The platform's rich data capabilities allow

drivers to capture photos as proof of delivery or record audio 'signatures' to confirm customer receipt. Its pre- and post-service web form option means customers can both state their preparedness for delivery—including adherence to safety regulations—and also provide post-delivery feedback. ProntoForms drives process refinement where it's needed most and keeps deliveries safe in the hands of drivers.

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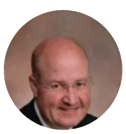
*Honeywell has partnered with Qualcomm in the design of SOM, guaranteeing compatibility through Android 11/R, and potentially through 13/T. What does potentially/committed mean? Pending any unforeseen design changes with Android 12 and 13, Honeywell with input from Google and Qualcomm, anticipate that with reasonable commercial efforts, SOM1 will be compatible.

[1] Solidarity in the last mile in the face of COVID-19



Barry J. Ewell

SPS BLOG EDITOR

Barry J. Ewell is a Senior Content Marketing Communications Specialist for Honeywell Safety and Productivity Solutions. He has been researching and writing on supply chain topics since 1991.

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Global Unsubscribe

Feedback

Exhibit 7

US005243655A

United States Patent [19]

Wang

[11] **Patent Number: 5,243,655**

[45] **Date of Patent: Sep. 7, 1993**

[54] **SYSTEM FOR ENCODING AND DECODING DATA IN MACHINE READABLE GRAPHIC FORM**

[75] Inventor: **Ynjiun P. Wang,** Stony Brook, N.Y.

[73] Assignee: **Symbol Technologies Inc.,** Bohemia, N.Y.

[21] Appl. No.: **851,505**

[22] Filed: **Mar. 16, 1992**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 461,881, Jan. 5, 1990, and Ser. No. 653,822, Feb. 11, 1991, Pat. No. 5,113,445, which is a continuation of Ser. No. 550,023, Jul. 9, 1990, abandoned.

[51] **Int. Cl.**[5] **H04L 9/00**

[52] **U.S. Cl.** **380/51;** 380/55; 380/3; 380/59; 235/462

[58] **Field of Search** 380/51, 55, 3, 59; 235/462

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,647,275	3/1972	Ward	350/3.5
3,676,644	7/1972	Vaccaro et al.	235/61
3,761,683	9/1973	Rogers	235/61
3,812,328	5/1974	Tramposch	235/61
4,654,718	3/1987	Sueyoshi	358/257
4,654,793	3/1987	Elrod	364/401
4,660,221	4/1987	Dlugos	380/23
4,794,239	12/1988	Allais	235/462
4,835,713	5/1989	Pastor	364/519
4,863,196	9/1989	Ohnishi et al.	283/82
4,893,333	1/1990	Baran et al.	379/100
4,908,873	3/1990	Philibert et al.	382/34
4,949,381	8/1990	Pastor	380/51
4,973,829	11/1990	Ishida	235/462
4,975,948	12/1990	Andresen et al.	379/355

FOREIGN PATENT DOCUMENTS

59-44157	3/1984	Japan .
62-91075	5/1987	Japan .

OTHER PUBLICATIONS

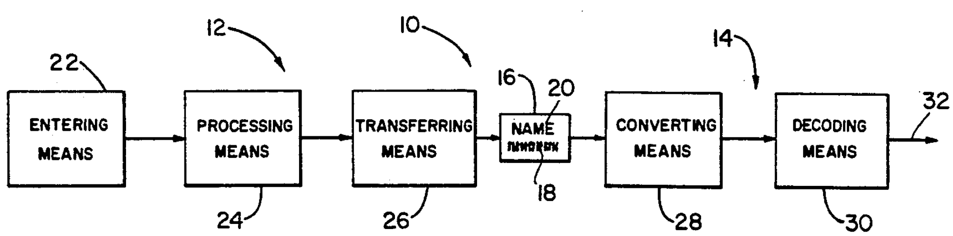
Wang et al., "Postal Applications of a High Density Bar Code" (Sep. 1990).
Wang, "PDF417 Specification" (1991).

Primary Examiner—David Cain

[57] **ABSTRACT**

A system for representing and recognizing data in machine readable graphic image form in which data to be encoded is entered into the system and a processor encodes the data into a two-dimensional bar code symbol and generates transfer drive signals representative of the symbol. A transferring device such as a printer transfers an image of the two-dimensional bar code symbol onto a carrier such as a card or paper document in response to the transfer drive signals. A recognition device converts the image on the carrier into electrical signals representative of the symbol by scanning the image. A low-level decoder decodes the signals by decoding each scan line into a vector of codeword values corresponding to the codewords in the two-dimensional bar code symbol, assigning a row number to each of the codeword values, and then filling in a two-dimensional matrix with the codeword values. A high-level decoder further decodes the codeword values into data which can then be output for processing or use.

32 Claims, 14 Drawing Sheets



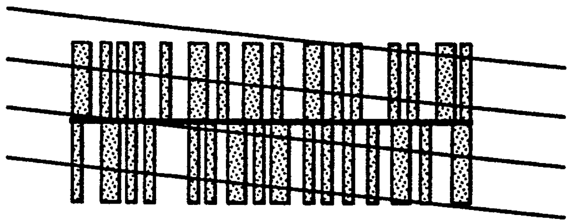


FIG. 1A

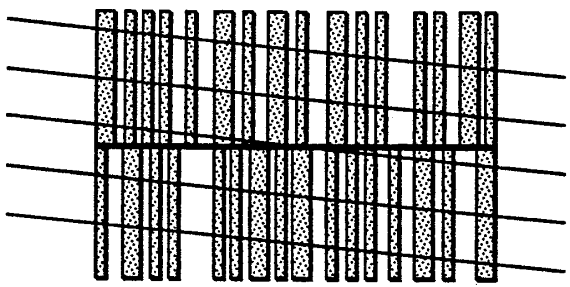


FIG. 1B

FIG. 2

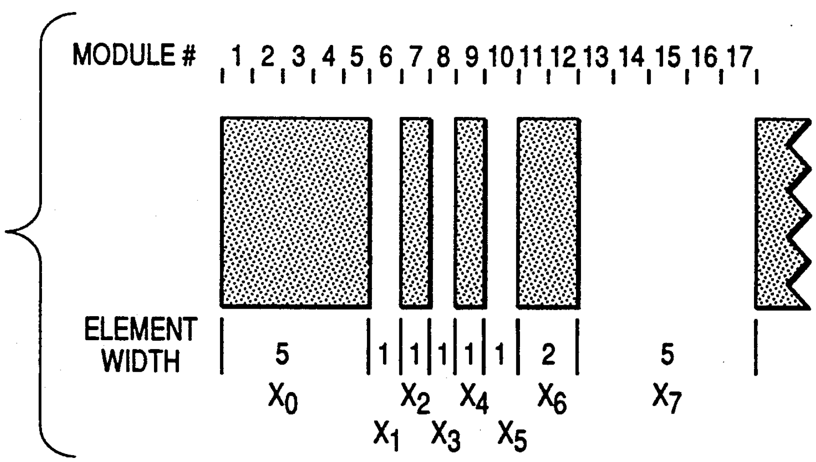


FIG. 3

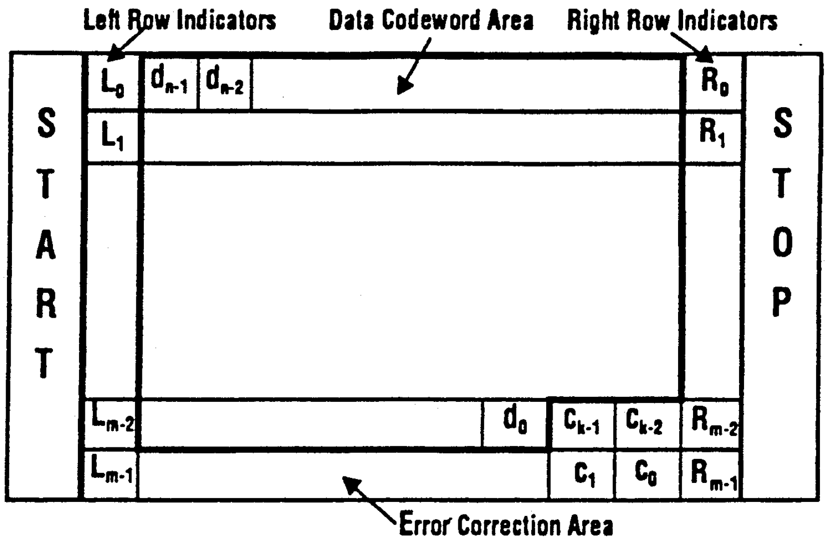


FIG. 4

PDF417 Security Level	
Security Level	**Error Correction Codewords**
0	0
1	2
2	6
3	14
4	30
5	62
6	126
7	254
8	510

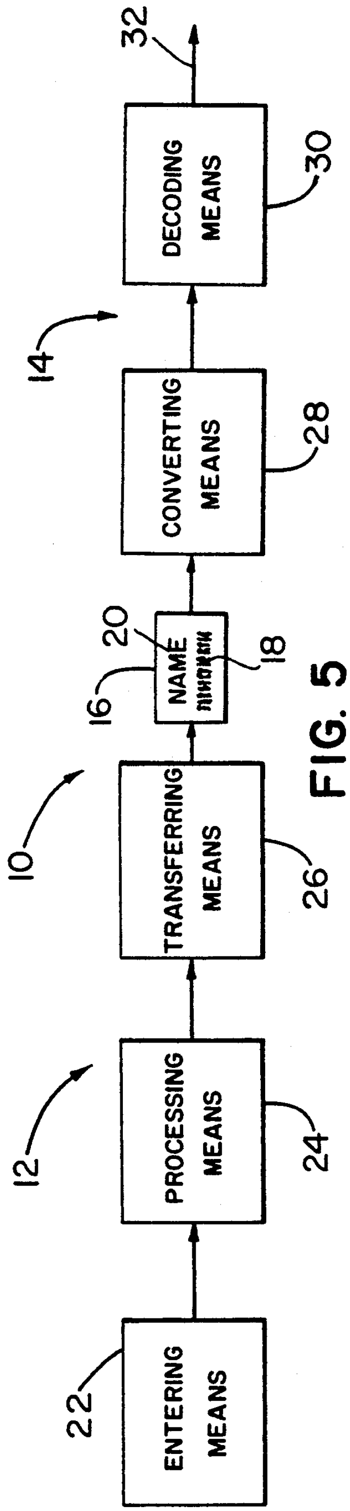

ENTERING MEANS
PROCESSING MEANS
TRANSFERRING MEANS
NAME
CONVERTING MEANS
DECODING MEANS
10
12
14
16
18
20
22
24
26
28
30
32

FIG. 5

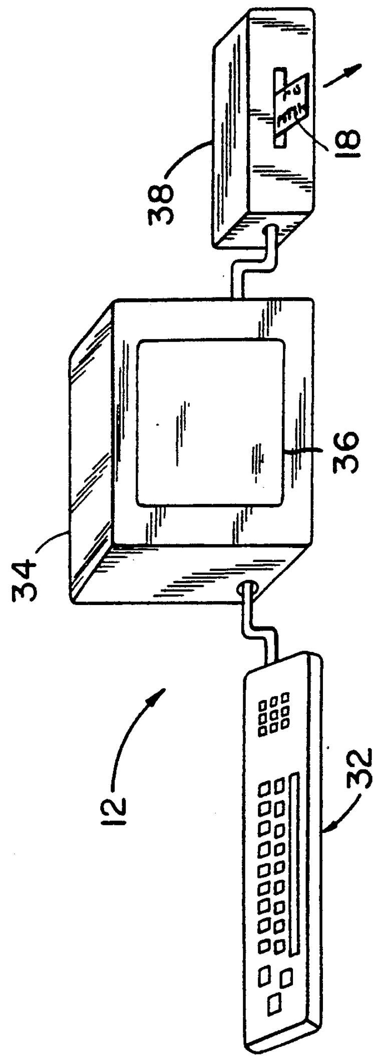

12
18
32
34
36
38

FIG. 6

FIG. 7

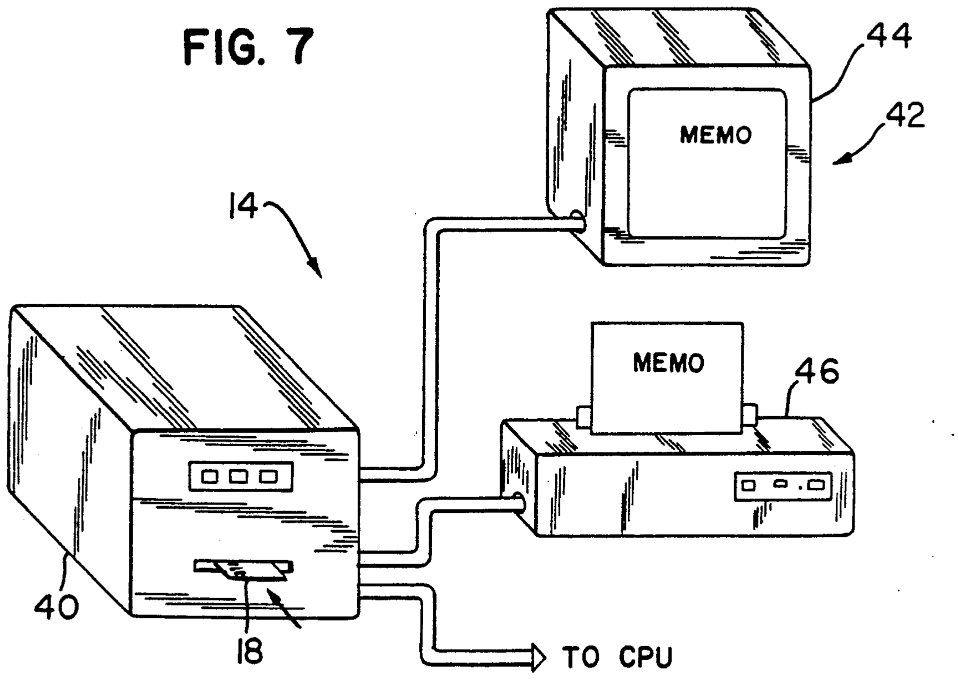


FIG. 8

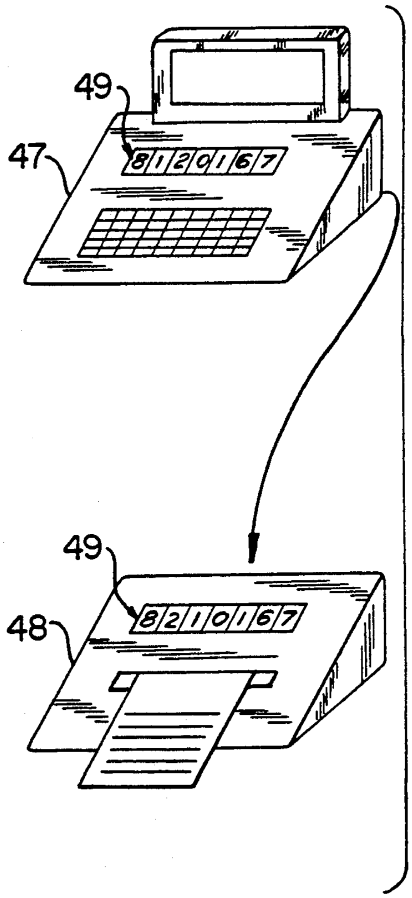
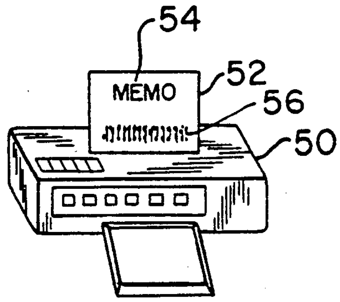


FIG. 9



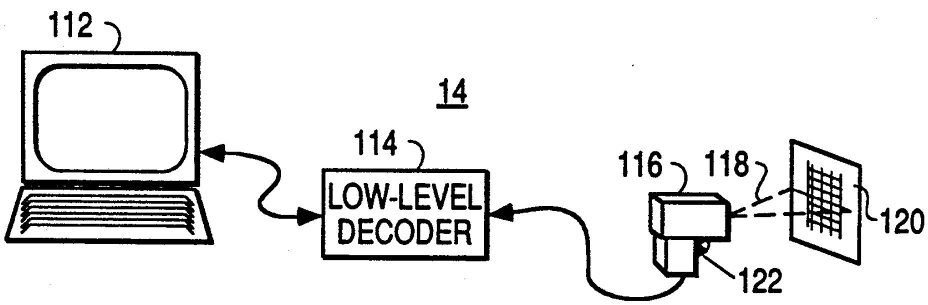

112
14
114
LOW-LEVEL DECODER
116
118
120
122

FIG. 10

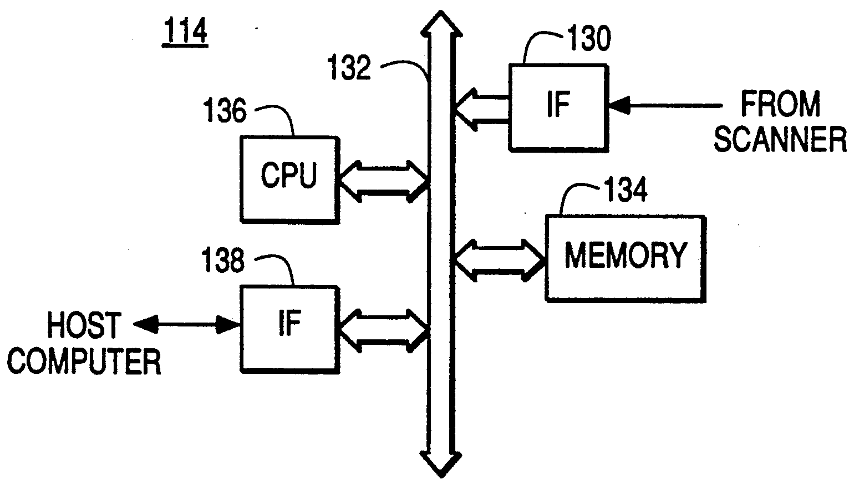

114
132
130
IF
FROM SCANNER
136
CPU
134
MEMORY
138
HOST COMPUTER
IF

FIG. 11

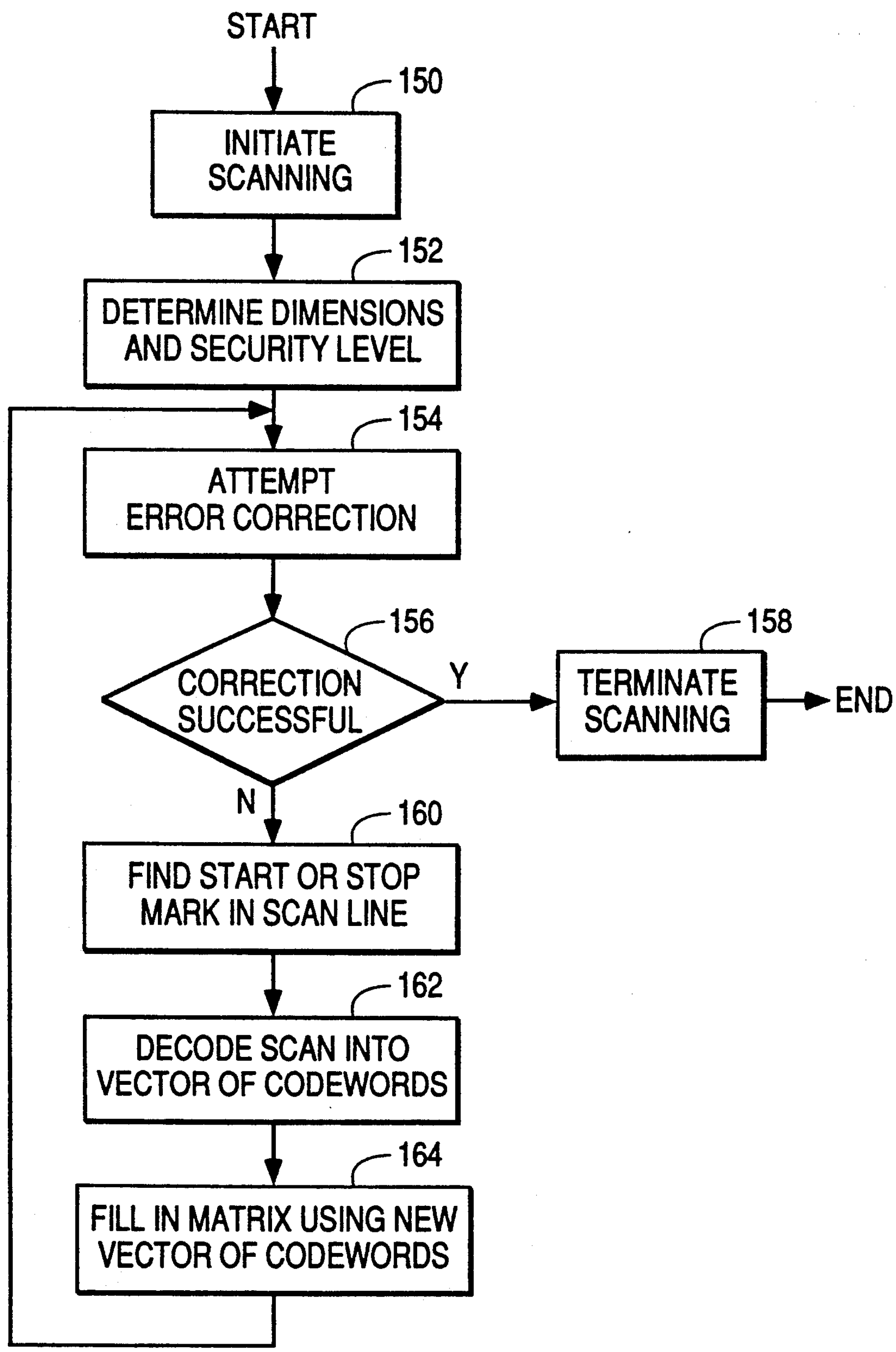

START
150
INITIATE SCANNING
152
DETERMINE DIMENSIONS AND SECURITY LEVEL
154
ATTEMPT ERROR CORRECTION
156
CORRECTION SUCCESSFUL
Y
158
TERMINATE SCANNING
END
N
160
FIND START OR STOP MARK IN SCAN LINE
162
DECODE SCAN INTO VECTOR OF CODEWORDS
164
FILL IN MATRIX USING NEW VECTOR OF CODEWORDS

FIG. 12

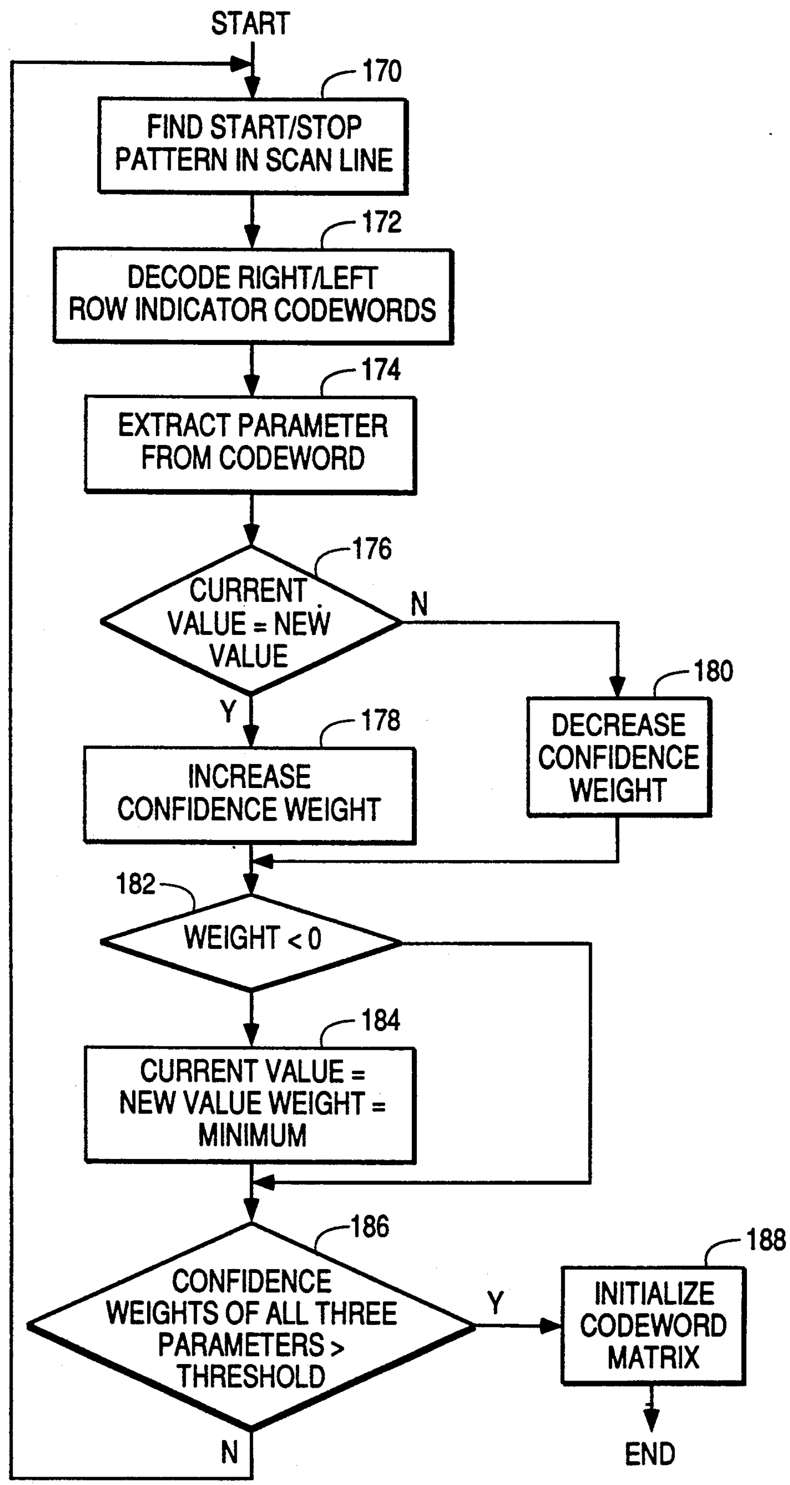

START
170
FIND START/STOP PATTERN IN SCAN LINE
172
DECODE RIGHT/LEFT ROW INDICATOR CODEWORDS
174
EXTRACT PARAMETER FROM CODEWORD
176
CURRENT VALUE = NEW VALUE
N
180
DECREASE CONFIDENCE WEIGHT
Y
178
INCREASE CONFIDENCE WEIGHT
182
WEIGHT < 0
184
CURRENT VALUE = NEW VALUE WEIGHT = MINIMUM
186
CONFIDENCE WEIGHTS OF ALL THREE PARAMETERS > THRESHOLD
Y
188
INITIALIZE CODEWORD MATRIX
END
N

FIG. 13

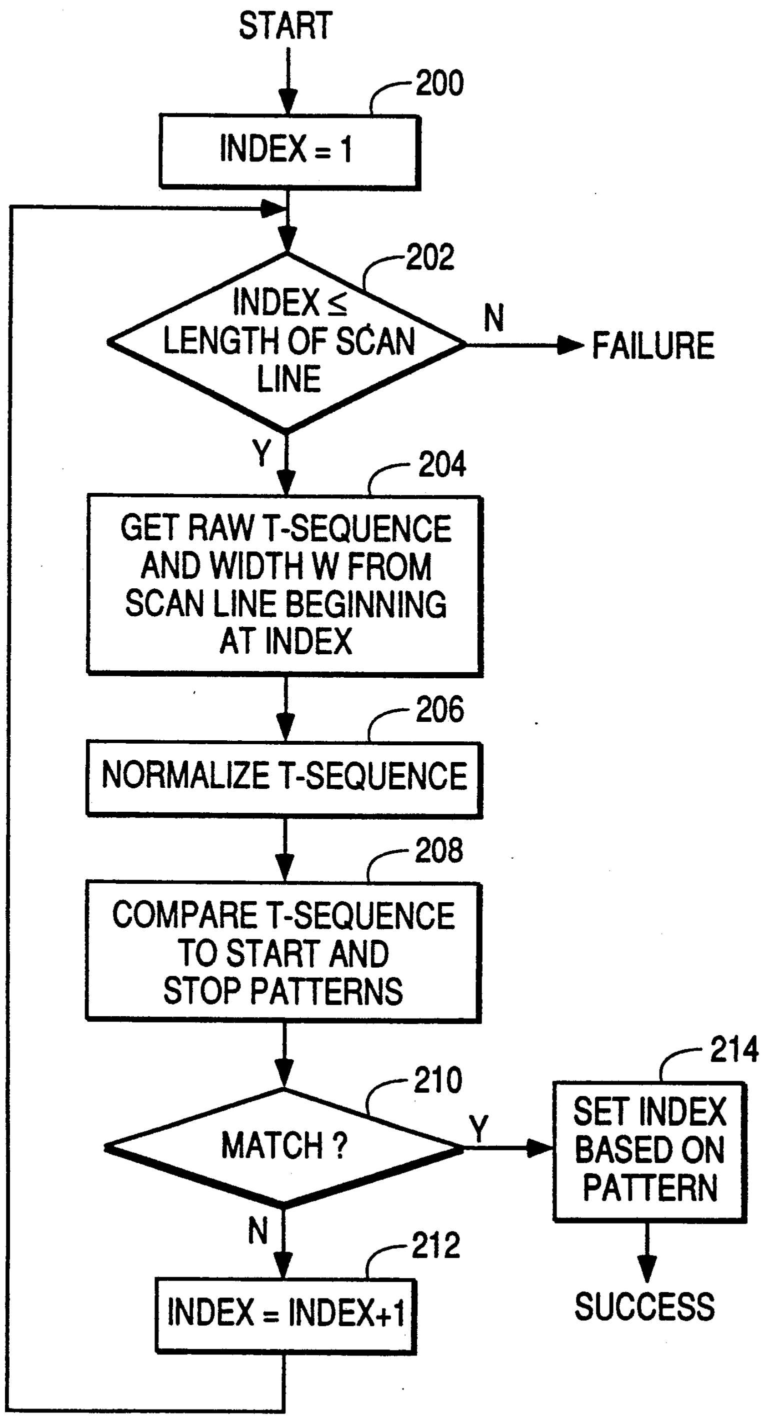
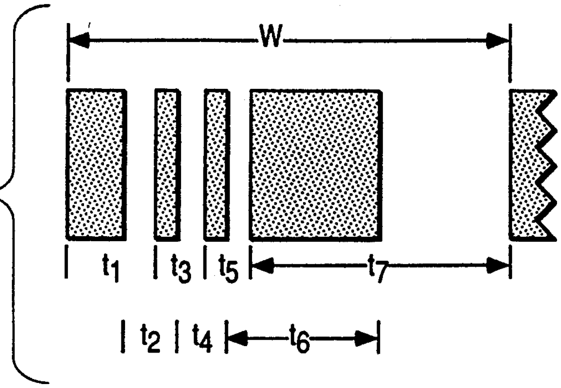

START
200
INDEX = 1
202
INDEX ≤ LENGTH OF SCAN LINE
N
FAILURE
Y
204
GET RAW T-SEQUENCE AND WIDTH W FROM SCAN LINE BEGINNING AT INDEX
206
NORMALIZE T-SEQUENCE
208
COMPARE T-SEQUENCE TO START AND STOP PATTERNS
210
MATCH ?
Y
214
SET INDEX BASED ON PATTERN
SUCCESS
N
212
INDEX = INDEX+1

FIG. 14

FIG. 15



COLUMN	1	2	3	4	5	6	7	8	9	10
VALUE	L_2	V	V	V	BAD	V	BAD	V	V	R_1
CLUSTER	6	6	6	6	BAD	3	BAD	3	3	3

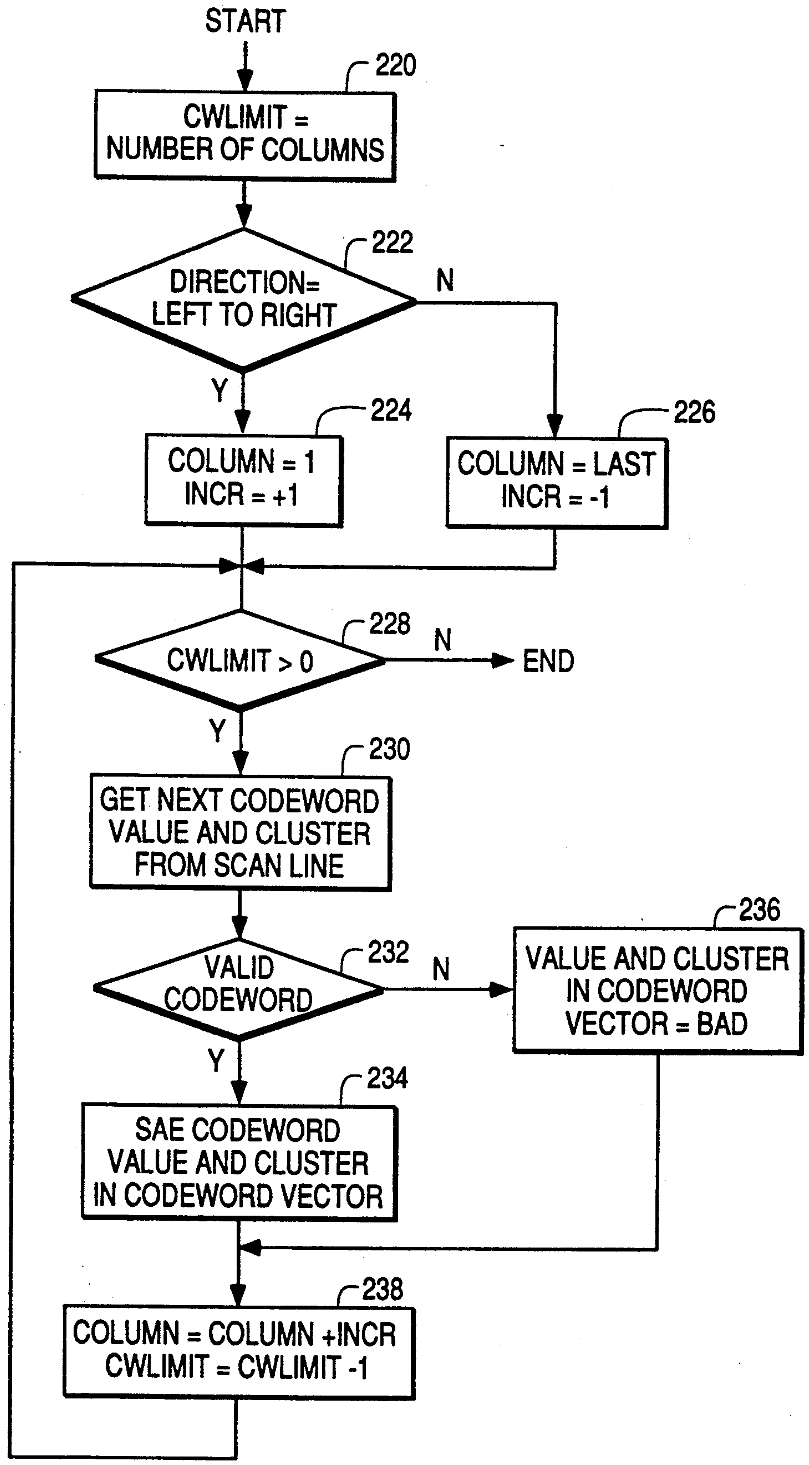
FIG. 17A

COLUMN	1	2	3	4	5	6	7	8	9	10
VALUE	L_2	V	V	V	BAD	V	BAD	V	V	R_1
CLUSTER	6	6	6	6	BAD	3	BAD	3	3	3
WEIGHT	H	H	H	M		L		M	H	H

FIG. 17B

COLUMN	1	2	3	4	5	6	7	8	9	10
VALUE	L_2	V	V	V	BAD	V	BAD	V	V	R_1
CLUSTER	6	6	6	6	BAD	3	BAD	3	3	3
WEIGHT	H	H	H	M		L		M	H	H
ROW	2	2	2	2		1		1	1	1

FIG. 17C



START
220
CWLIMIT = NUMBER OF COLUMNS
222
DIRECTION= LEFT TO RIGHT
N
Y
224
COLUMN = 1 INCR = +1
226
COLUMN = LAST INCR = -1
228
CWLIMIT > 0
N
END
Y
230
GET NEXT CODEWORD VALUE AND CLUSTER FROM SCAN LINE
232
VALID CODEWORD
N
236
VALUE AND CLUSTER IN CODEWORD VECTOR = BAD
Y
234
SAE CODEWORD VALUE AND CLUSTER IN CODEWORD VECTOR
238
COLUMN = COLUMN +INCR CWLIMIT = CWLIMIT -1

FIG. 16

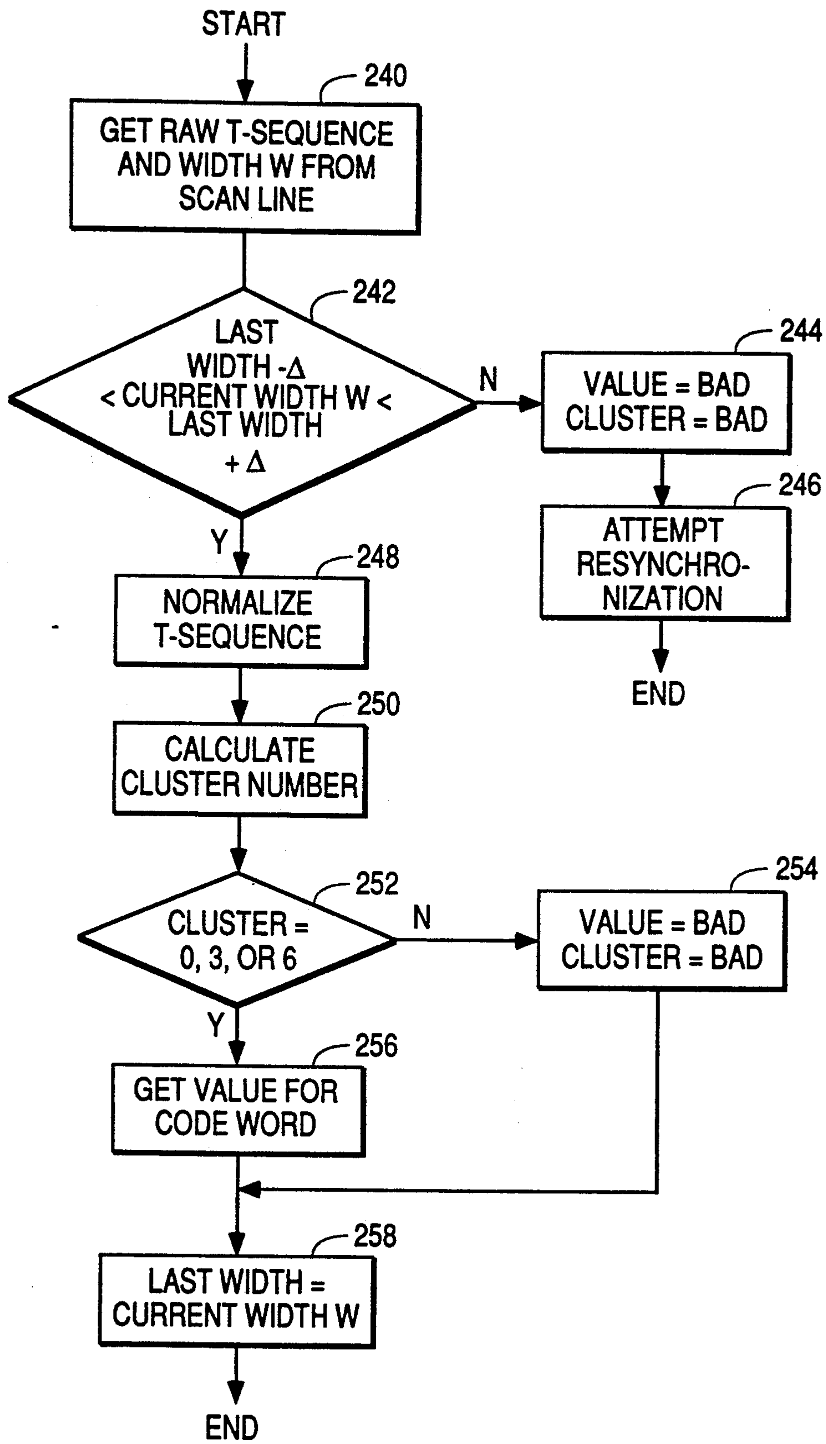

START
240
GET RAW T-SEQUENCE AND WIDTH W FROM SCAN LINE
242
LAST WIDTH -Δ < CURRENT WIDTH W < LAST WIDTH + Δ
N
244
VALUE = BAD CLUSTER = BAD
246
ATTEMPT RESYNCHRO-NIZATION
END
Y
248
NORMALIZE T-SEQUENCE
250
CALCULATE CLUSTER NUMBER
252
CLUSTER = 0, 3, OR 6
N
254
VALUE = BAD CLUSTER = BAD
Y
256
GET VALUE FOR CODE WORD
258
LAST WIDTH = CURRENT WIDTH W
END

FIG. 18

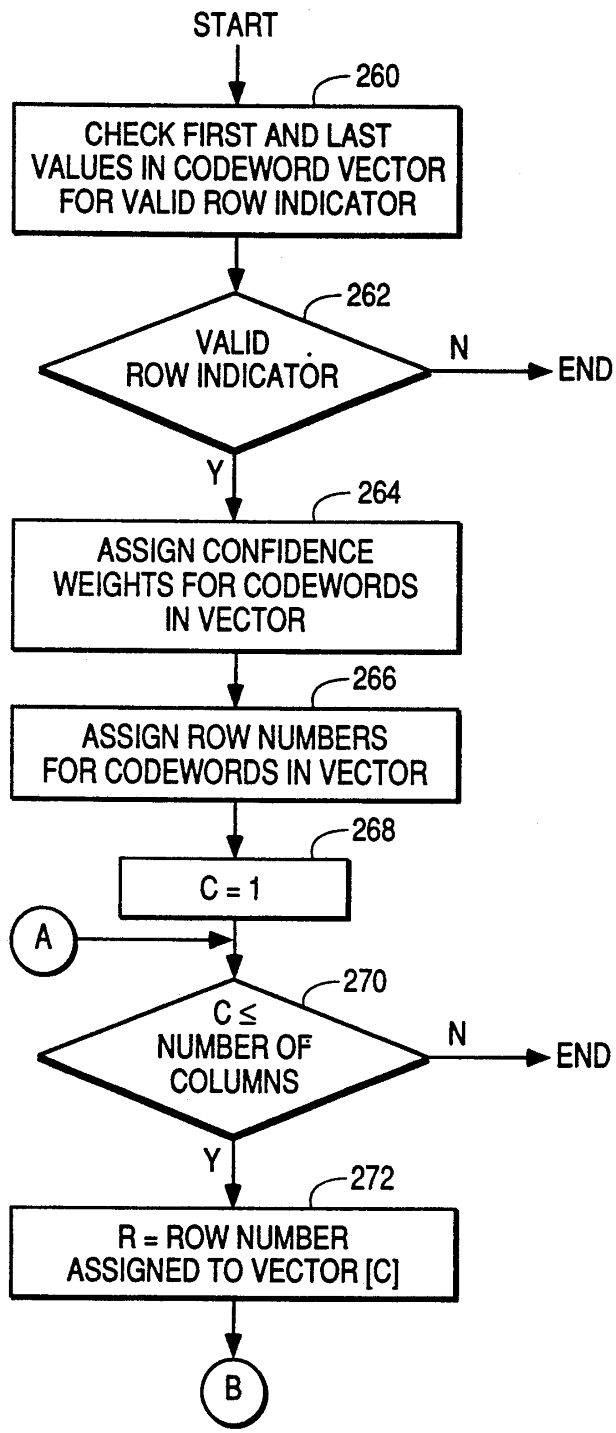

START
260
CHECK FIRST AND LAST VALUES IN CODEWORD VECTOR FOR VALID ROW INDICATOR
262
VALID ROW INDICATOR
N
END
Y
264
ASSIGN CONFIDENCE WEIGHTS FOR CODEWORDS IN VECTOR
266
ASSIGN ROW NUMBERS FOR CODEWORDS IN VECTOR
268
C = 1
A
270
C ≤ NUMBER OF COLUMNS
N
END
Y
272
R = ROW NUMBER ASSIGNED TO VECTOR [C]
B

FIG. 19A

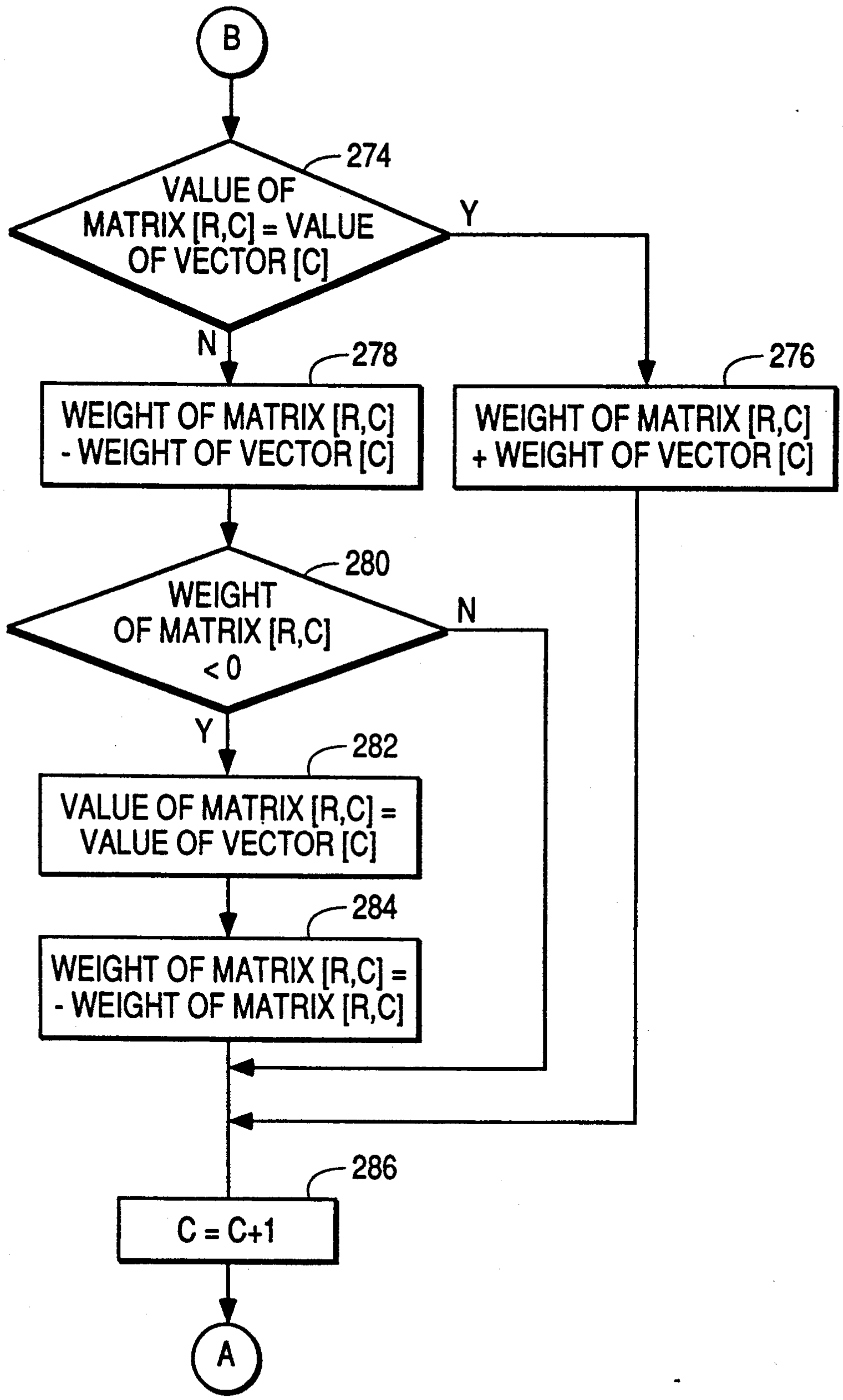

B
274
VALUE OF MATRIX [R,C] = VALUE OF VECTOR [C]
Y
N
278
WEIGHT OF MATRIX [R,C] - WEIGHT OF VECTOR [C]
276
WEIGHT OF MATRIX [R,C] + WEIGHT OF VECTOR [C]
280
WEIGHT OF MATRIX [R,C] < 0
N
Y
282
VALUE OF MATRIX [R,C] = VALUE OF VECTOR [C]
284
WEIGHT OF MATRIX [R,C] = - WEIGHT OF MATRIX [R,C]
286
C = C+1
A

FIG. 19B

SYSTEM FOR ENCODING AND DECODING DATA IN MACHINE READABLE GRAPHIC FORM

This application is a continuation-in-part of application Ser. No. 07/653,822, filed Feb. 11, 1991, issued as U.S. Pat. No. 5,113,445 on May 12, 1992, which is a continuation application of application Ser. No. 07/550,023, filed Jul. 9, 1990, abandoned. This application is also a continuation-in-part of application Ser. No. 07/461,881, filed Jan. 5, 1990.

BACKGROUND OF THE INVENTION

The present invention generally relates to the representation of data in machine readable form, and more particularly to a method and apparatus for encoding and decoding data into a two-dimensional graphic image, such as the two-dimensional bar code PDF417, that can be automatically machine read to obtain the encoded data in both open and closed systems.

In today's high-technology world, more and more operations are being automatically performed by machines and systems. This ever-increasing drive for automation has resulted in a demand for new techniques for encoding data into machine readable form for automatic entry into the various systems and machinery. The data entry may be for such uses as data transmission, operating various machine functions or the identification of persons or items. The various media that carry the data for automatic entry include punch cards, magnetic tapes and discs and magnetic stripes on cards such as credit cards and badges. The systems utilizing the above carriers are in "closed" systems, i.e., the read function is performed within an apparatus or housing and the reading element is in contact or in near-contact with the carrier means during the reading operation.

One method for representing data in a machine readable form is to encode the data into a pattern of indicia having parts of different light reflectivity, for example, bar code symbols. A bar code symbol is a pattern comprised of a series of bars of various widths and spaced apart from one another by spaces of various widths, the bars and spaces having different light reflective properties. The bars represent strings of binary ones and the spaces represent strings of binary zeros. Generally, the bars and spaces can be no smaller than a specified minimum width which is called a "module" or "unit." The bars and spaces are multiples of this module size or minimum width.

Bar code symbols are typically printed directly on the object or on labels that are attached to the object. The bar code symbols are read by optical techniques, such as scanning laser beams or CCD cameras, and the resulting electrical signals are decoded into data representative of the symbol for further processing. Bar code reading systems are known as "open" systems in that the carrier while being read is not sealed, but is read from a distance and without being in physical contact with the scanner.

The conventional bar code described above is "one-dimensional" in that the information encoded therein is represented by the width of the bars and spaces, which extend in a single dimension. Thus, a bar code of a supermarket item, for example, consists of a string of eleven digits which represent an identifying number, but not a description of the item. The remainder of the relevant information, such as the price, name of the product, manufacturer, weight, inventory data, and expiration date, must be obtained from a database using the identification number. Similarly, data encoded onto other media such as credit card magnetic stripes is composed of one or more "one-dimensional" tracks of encoded data.

The use of bar code symbols and magnetically encoded data has found wide acceptance in almost every type of industry. However, the one-dimensional nature of the encoded data limits the amount of information that can be encoded and hence use has been generally restricted to simple digital representations.

There is an increasing need, however, for a system to encode data in machine readable form that allows for an increase in the amount of data encoded into a given space that can be quickly and easily decoded for further processing. In particular, there is a desire to create "portable data files" which provide more than an identification number which is then used as an index to reference a database. The "portable data file" approach is well-suited to applications where it is impractical to store item information in a database or where the database is not readily accessible when and where the bar code is read. For example, information such as the contents of a shipping manifest or an equipment maintenance history could be carried directly on the object without requiring access to a remote database. Similarly, a hospital could use portable data files to put more medical information on patient identification bracelets. In a manufacturing environment, portable data files could be used to keep production records or even to provide instructions to control machine operations. Ideally, such portable data files could contain up to several hundred or more characters in a relatively small area, but still be read from a distance by a hand-held laser scanner.

One approach for increasing the information in machine-readable symbols is to reduce the height of the bar codes and stack the bar codes one on top of each other to create a "stacked" or "two-dimensional" bar code. A major problem in reading two-dimensional symbols, however, is the loss of vertical synchronization. As shown in FIG. 1A, if the data rows are too short or the scan line intersects the row at a large angle, the scan lines will not coincide with the horizontal lines of the pattern. The height of the rows can be increased as shown in FIG. 1B, but this causes an obvious reduction of information density.

A proposed solution to the vertical synchronization problem is to include both row identifiers and local row discriminators in the two-dimensional bar code symbol in order to distinguish between the rows. One such two-dimensional bar code with row identifiers and local row discriminators is PDF417, which was developed by Symbol Technologies, Inc. A more complete description of PDF417 is contained in U.S. patent application Ser. No. 07/461,881, filed Jan. 5, 1990, and assigned to the same assignee as the present invention, which is hereby incorporated by reference.

Even if the symbol is constructed so that the rows can be distinguished from one another, however, there remains the problem of how to decode such a symbol efficiently. In particular, it is not enough for a decoding method or apparatus to simply recognize that a scan line crossed a row boundary.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a system for representing and recognizing data in ma-

chine readable graphic image form having an increased capacity for encoded information that can be used in both open and closed systems. The system comprises an encoding means having a means for entering data such as a keyboard or optical character scanner. In addition, the data may be obtained directly from computer files. The data entered into the system may be both textual data and control data. The data is entered into a processing means for encoding the data into a two-dimensional pattern of graphic indicia.

The graphic indicia may, for example, be in the form of a two-dimensional bar code which is comprised of a pattern of vertical bars of predetermined lengths that are spaced at various vertical and horizontal intervals. The two-dimensional bar code symbol, which may be a PDF417 symbol, preferably includes a plurality of ordered, adjacent rows of codewords of bar-coded information from a set of codewords, the set of codewords being partitioned into at least three mutually exclusive clusters, each row in the symbol having at least one row indicator codeword and containing only codewords from a cluster different from the codewords in an adjacent row. It should be understood, however, that the graphic indicia representative of the data is not limited to two-dimensional bar codes such as PDF417, but may be in the form of any two-dimensional graphic pattern of indicia suitable for encoding data.

The processing means generates electrical drive signals for transferring the two-dimensional graphic pattern onto a data carrier means, that may be a card or document or the surface of a machine part. The encoding means also includes means for transferring an image of the two-dimensional pattern of graphic indicia onto the data carrier means in response to the transfer drive signals. The image may for example be printed in the form of a two-dimensional pattern of graphic indicia having different areas of light reflectivity in which the indicia have one level of reflectivity and the spaces have another level of reflectivity. In this embodiment, the converting means may be a type of optical scanner typically used for scanning one-dimensional bar codes that converts the areas of different light reflectivity into electrical signals representative of the indicia. Scanners employed in the present invention, however, have the added feature of scanning the indicia in two dimensions. For example, in one method a laser light beam is scanned across the indicia in a raster pattern for reading and decoding two-dimensional graphic codes. Optical scanners suitable for reading two-dimensional patterns are disclosed in U.S. patent application Ser. Nos. 317,433 and 317,533, filed on Mar. 1, 1989, assigned to the same assignee as the present invention and incorporated herein by reference.

The system of the present invention further includes recognition means comprising means for converting the image on the carrier means into electrical signals representative of the graphic indicia and means for decoding the electrical signals into output signals representative of the data.

Where the converting means is a hand-held laser scanner, in order to decode the electrical signals representing the graphic indicia efficiently, the decoding means should be able to decode the signals even though the scan lines cross a row boundary. In particular, where the graphic indicia is a two-dimensional bar code symbol, such as PDF417, which has both row indicators and local row discriminators, the electrical signals obtained from scanning the symbol may be decoded in such a way that partial scans from different rows can be stitched together. This allows greater scanning angles and lower aspect ratios of the rows, which in turn makes possible hand-held laser scanning of two-dimensional bar code symbols.

Accordingly, the decoding means for decoding the two-dimensional bar code symbol, in accordance with the invention, comprises: means for scanning the two-dimensional bar code symbol to produce scan lines of data representing the bar-coded information in the codewords of the symbol; means for decoding a scan line of data into a vector of codeword values corresponding to the codewords that were scanned, at least one of the values being for a row indicator codeword; means for assigning a row number to each of the codeword values in the vector based on the value of the row indicator codeword and the cluster of the codeword; and means for filling in a codeword matrix with the codeword values in the vector according to their assigned row numbers.

In a two-dimensional bar code symbol such as PDF417, the row indicator codewords may also contain information regarding the number of rows in the symbol and the number of codewords in each row. Where this is the case, one embodiment of the decoding means includes both means for decoding a scan line of data to obtain a codeword value for a row indicator codeword, and means for determining either the number of rows or the number of columns from the codeword value corresponding to a row indicator codeword.

The two-dimensional bar code symbol may also contain one or more error correction codewords. Another aspect of the decoding means of the invention therefore includes means for locating in the matrix the codeword values for any codewords that have not been successfully decoded, and means for correcting any erroneous codeword values in the codeword matrix using the error correction codeword.

The decoded output signals are available for further processing and the system may therefore include means for outputting the decoder output signals. Typical output devices may include a liquid crystal display, a CRT display and a printer. The outputted signals may also be transmitted to a computer or other system for further processing and use via telephone lines using a modem or via a data bus. The present invention contemplates the outputting of the decoder output signals to a microprocessor for controlling the operation of various machines such as facsimile, VCR, microwave oven, robotic systems and weight/price label scale devices.

In another embodiment of the invention, the processing means encodes a first set of data into the two-dimensional pattern of graphic indicia and generates first transfer drive signals for transferring the two-dimensional pattern onto a carrier means. The processing means also generates a second set of transfer drive signals in response to a second set of data entered into the system intended to be transferred to the carrier means in human readable form. Thereafter, the transfer means transfers onto the carrier means both the image of the two-dimensional graphic pattern of indicia in response to the first transfer drive signals and the second set of data in human readable form in response to the second transfer drive signals. Thus, the system provides means for automatically representing data in both a machine readable form and human readable form onto a single carrier means.

In yet another embodiment of the invention, the data is encoded and decoded using a keyed data encryption technique in order to increase the security of the data transmission. In this embodiment, only the person having the encryption key will be able to decode the graphic pattern.

The system of the present invention maximizes the use of available space for encrypting data. In addition to being compact in size, the system provides for high security in the transmission of information. Thus, the invention provides a highly reliable system for representing data in machine readable graphic form having increased encoding capacity thereby substantially expanding applications for automatic data entry. In addition, the invention creates a new media for man-machine interfacing.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention as claimed.

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate an embodiment of the invention and together with the general description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1A** and **1B** are diagrams illustrating the intersection of scan lines with the rows of a two-dimensional bar code symbol;

FIG. **2** is a diagram illustrating one example of a codeword in PDF417;

FIG. **3** is a diagram illustrating the overall structure of a PDF417 symbol;

FIG. **4** is a table listing the number of error correction codewords for a given security level in PDF417;

FIG. **5** is a block diagram of the system of the present invention;

FIG. **6** is a perspective view of an encoding means of the system of the present invention;

FIG. **7** is a perspective view of a recognition means of the system of the present invention;

FIG. **8** is a perspective view of a data entry device and reader in which a key may be entered for encrypting and decrypting data;

FIG. **9** is a perspective view of a facsimile machine incorporating the recognition means of the present invention;

FIG. **10** is a schematic diagram of another embodiment of recognition means for scanning and decoding a two-dimensional bar code symbol;

FIG. **11** is a schematic block diagram of an embodiment of the hardware apparatus of a low-level decoder for decoding a two-dimensional bar code symbol;

FIG. **12** is a flow diagram of the steps performed by the low-level decoder for decoding a two-dimensional bar code symbol;

FIG. **13** is a flow diagram of the steps performed by the low-level decoder for determining the dimensions and security level of the symbol being scanned;

FIG. **14** is a flow diagram of the steps performed by the low-level decoder for searching a scan line of data for a start or a stop pattern;

FIG. **15** is a diagram illustrating the various width measurements that are used for the "t-sequence" of a codeword;

FIG. **16** is a flow diagram of the steps performed by the low-level decoder for decoding a scan line of data into a vector of codeword values and their cluster numbers;

FIGS. **17A**, **17B**, and **17C** are diagrams showing an example of a codeword vector;

FIG. **18** is a flow diagram of the steps performed by the low-level decoder for decoding an individual codeword value and its cluster number from the scan line data; and

FIGS..**19A** and **19B** together are a flow diagram of the steps performed by the low-level decoder in order to update the codeword matrix using the codeword vector.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the presently preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings.

Code PDF417

Before discussing the method and apparatus of the invention for encoding and decoding data in machine readable graphic form, such as the two-dimensional bar code PDF417, it is important to understand the structure of the two-dimensional bar code symbol itself.

Each PDF417 symbol is composed of a stack of rows of bar-coded information. Each row in the symbol consists of a start pattern, several symbol characters called "codewords," and a stop pattern. A codeword is the basic unit for encoding a value representing, or associated with, certain numbers, letters, or other symbols. Collectively, the codewords in each row form data columns.

Both the number of rows and the number of data columns of the PDF417 symbol are variable. The symbol must have at least three rows and may have up to ninety rows. Likewise, within each row, the number of codewords or data columns can vary from three to thirty.

Each PDF417 codeword consists of seventeen modules or units. There are four bars and four spaces in each codeword. Individual bars or spaces can vary in width from one to six modules, but the combined total per codeword is always seventeen modules. Thus, each codeword can be defined by an eight-digit sequence, which represents the four sets of alternating bar and space widths within the codeword. This is called the "X-sequence" of the codeword and may be represented by the sequence $X_0, X_1, \ldots X_7$. For example, for an X-sequence of "51111125", the first element is five modules wide, followed by five elements one module wide, one element two modules wide, and the last element five modules wide. This example is illustrated in FIG. 2.

The set of possible codewords is further partitioned into three mutually exclusive subsets called "clusters." In the PDF417 symbol, each row uses only one of the three clusters to encode data, and each cluster repeats sequentially every third row. Because any two adjacent rows use different clusters, the decoder is able to discriminate between codewords from different rows within the same scan line.

The cluster number of a codeword may be determined from its X-sequence using the following formula:

$$\text{cluster number} = (X_0 - X_2 30\ X_4 - X_6) \bmod 9$$

where "mod 9" is the remainder after division by nine. Referring to the codeword in FIG. 2, the cluster number is calculated as follows:

cluster number=(5−1+1−2) mod 9=3

To minimize error probabilities, PDF417 uses only three clusters, even though nine are mathematically possible. Thus, each row uses only one of the three clusters **0**, **3**, or **6**, to encode data, with the same cluster repeating sequentially every third row. Row **0** codewords, for example, use cluster **0**, row **1** uses cluster **3**, and row **2** uses cluster **6**, etc. In general, the cluster number may be determined from the row number as follows:

cluster number=((row number) mod 3) * 3

There are 929 codeword values defined in PDF417. These values are 0 through 928. Each cluster presents the 929 available values with distinct bar-space patterns so that one cluster cannot be confused with another.

FIG. **3** is a block diagram showing the overall structure of a PDF417 symbol. Each row of the symbol consists of a start pattern, a left row indicator codeword L_i, data codewords d_i or error detection/correction codewords C_i, a right row indicator codeword R_i, and a stop pattern. The minimum number of codewords in a row is three, including the left row indicator codeword, at least one data codeword, and the right row indicator codeword. The right and left row indicator codewords, which are discussed further below, help synchronize the structure of the symbol.

The start and stop patterns identify where each row of the symbol begins and ends. PDF417 uses unique start and stop patterns. The start pattern, or left side of each row, has the unique pattern, or X-sequence, of "81111113". The stop pattern, or right side of each row, has the unique X-sequence of "711311121".

Every symbol contains one codeword (the first data codeword in row **0**) indicating the total number of codewords within the symbol, and at least two error-detection codewords C_0 and C_1. These two error-detection codewords together form a checksum which is two codewords long.

A PDF417 symbol can also encode data with error correction capability. The level of error correction capability, called the "security level," is selected by the user and ranges from **0** to **8**. This means, for example, that at level **6**, a total of 126 codewords can be either missing or destroyed and the entire symbol can be read and decoded. FIG. **5** is a table showing the relationship between the security level of the PDF417 symbol and the number of error correction codewords C_i.

In addition to correcting for missing or destroyed data (known as "erasures"), PDF417 can also recover from misdecodes of codewords. Since it requires two codewords to recover from a misdecode, one to detect the error and one to correct it, a given security level can support half the number of misdecodes that it can of undecoded codewords.

The row indicator codewords in a PDF417 symbol contain several key components: row number, number of rows, number of data columns, and security level. Not every row indicator contains every component, however. The information is spread over several rows, and the pattern repeats itself every three rows. The pattern for encoding the information in the row indicator codewords can be illustrated as follows:

Row 0:	L_0 (row #, # of rows)	R_0 (row #, # of columns)
Row 1:	L_1 (row #, security level)	R_1 (row #, # of rows)
Row 2:	L_2 (row #, # of columns)	R_2 (row #, security level)
Row 3:	L_3 (row #, # of rows)	R_3 (row #, # of columns)
	etc.	

In other words, the left row indicator codeword L_0 for the first row **0** contains the row number (**0**) and the total number of rows in the symbol. The right row indicator codeword R_0 for row **0** contains the row number (**0**) and the number of data columns in the symbol, and so on.

Encoding data into a PDF417 symbol is typically a two-step process. First, data is converted into codeword values of **0** to **928**, which represent the data. This is known as "high-level encoding." The values are then physically represented by particular bar-space patterns, which is known as "low-level encoding."

Encoding/Decoding System

Referring now to FIGS. **5**-**7** in the drawings, FIG. **5** is a block diagram of the system **10** of the present invention for representing and recognizing data in machine readable graphic image form. System **10** includes an encoding means generally indicated by the reference numeral **12** and a recognition means generally indicated by the reference numeral **14**. Encoding means **12** produces a carrier means **16** containing at least a two-dimensional pattern of graphic indicia **18**. Carrier means **16** may also contain human readable data **20**. The two-dimensional pattern of graphic indicia on carrier means **16** is recognized by recognition means **14** to produce output signals representative of the data encoded into the pattern **18**.

Data to be transferred onto carrier means **16** is entered by entering means **22** into the encoding means **12**. The data entered by entering means **22** may be both the data to be encoded into the two-dimensional pattern of graphic indicia and the data to appear on carrier means **16** in human readable form. Processing means **24** encodes the set of data to appear in pattern **18** into a two-dimensional pattern of graphic indicia and generates transfer drive signals for controlling the transfer of the indicia onto the carrier means **16**. Transferring means **26** transfers an image of the two-dimensional pattern of graphic indicia onto carrier means **16** in response to the transfer drive signals. If human readable data is also to be transferred onto carrier **16**, the processing means **24** generates a second set of transfer drive signals for controlling the transfer of the human readable data onto carrier **16**. A portion or all of the data to be encoded and the human readable data may be transferred from a storage memory in processing means **24** or other computer files rather than being entered by means **22**.

The carrier means **16** shown in FIGS. **5**, **6**, and **7** is represented as being in the form of a card approximately the size of a credit card. This type of card is illustrative only as the carrier means **16** may be made of any material on which graphic indicia may be transferred to, such as paper, etc.

Recognition means **14** includes converting means **28** that converts the image on carrier means **16** into electrical signals representative of the graphic indicia. Decoding means **30** decodes the electrical signals into decoder

output signals indicated at **32** that are representative of the data encoded into the pattern **18**.

FIG. **6** is a perspective view of one embodiment of encoding means **12**. In this embodiment, the entering means **22** of FIG. **5** is shown in form of a keyboard **32** for entering alphanumeric and graphic data into the encoding means **12**. The embodiment of FIG. **6** is illustrative only as entering means **22** may take forms other than a keyboard such as an optical scanning means for scanning data directly from documents for entry into the encoding means **12**. Entering means **22** may also be in the form of various card readers in which magnetically encoded information is scanned and converted into electrical signals representative of the data.

Referring again to FIG. **6**, the processing means **24** of FIG. **5** is shown in the form of a processor and display unit **34**. The data entered by keyboard **32** is transmitted to the processor and display unit **34** for storage and processing. In addition to entering data, the keyboard **32** is also used for entering control commands to effect operation of the processor unit **34**.

The data entered by keyboard **32** is displayed on display screen **36** and upon entry of a proper control command, is also stored in memory. The data to be encoded into the pattern of graphic indicia is stored in a first memory, in processor **34** and the data, if any, to be transferred in human readable form is stored in a second memory. Alternatively, the data may be stored in a separate portion of a single memory. Upon the appropriate control command from keyboard **32**, the processor unit **34** encodes the data in the first memory into a two-dimensional pattern of graphic indicia and generates first transfer drive signals representative of the data stored in the first memory. The processor unit **34** also generates second transfer drive signals representative of the data stored in the second memory.

The processor unit **34** is shown in FIG. **6** as being coupled to a printer **38**. The printer **38** is one form of the transferring means **26** of FIG. **5**. Printer **38** transfers an image of the two-dimensional pattern of graphic indicia on carrier means **18** in response to the first transfer drive signals and prints the second set of data in human readable form onto carrier means **18** in response to the second transfer drive signals. In one embodiment, the printer **38** prints the two-dimensional pattern in the form of graphic indicia having different areas of light reflectivity, such as the two-dimensional bar code described above. Printer **38** may take other forms such as a means for printing the two-dimensional pattern of graphic indicia with magnetic-ink. In such a device, magnetic indicia are deposited on the carrier material in a two-dimensional pattern that may be recognized by magnetic-ink recognition sensors.

Turning now to FIG. **7**, the recognition means **14** includes a card reader **40** which contains the converting means **28** and the decoding means **30** of FIG. **5**. The converting means **28** may be a bar code reader such as those disclosed in U.S. patent application Ser. Nos. 317,433 and 317,533, assigned to the same assignee as the present invention and incorporated herein by reference. The readers disclosed in the above patent applications are open system devices designed to read an optically encoded two-dimensional bar code and to convert the light reflected from the pattern into electrical signals representative of the graphic indicia.

The card reader **40** may also comprise a magnetic-ink recognition device for reading and decoding magnetically encoded data. These closed system devices include a magnetic read head that senses the change in reluctance associated with the presence of the magnetic-ink. The use of appropriate converting means that corresponds to the particular data encoding technology employed is contemplated by the present invention.

The decoding means **30** decodes the electrical signals into output signals representative of the data encoded onto carrier means **18**. The decoder output signals are outputted from the recognition unit **40** to various output means **42**. FIG. **7** depicts two examples of output devices, one being a display unit **44** and the other a printer **46**. Display unit **44** may be any suitable display such as liquid crystal display or a CRT. The printer **46** may be any print device such as a dot matrix printer, laser printer, etc.

The system of the present invention maximizes the use of available space for encrypting data. The density of the encoded data is such that for a two-dimensional bar code symbol, a minimum of about 1600 characters can be encoded into a space of approximately $5'' \times \frac{1}{2}''$. In addition to being compact in size, the system provides for high security in the transmission of information. For example, a sensitive message may be encoded onto a document also containing non-sensitive material. This document, the same as any document, can be copied, transmitted by facsimile, etc., but only those with a recognition means of the present invention will be able to "read" the sensitive portion. The carrier means, being a single sheet of paper or a plastic credit card type of card, is an inexpensive read-only-memory structure that facilitates data communication.

In another embodiment, the data may be encoded using a keyed encryption algorithm that may be accessed only by an encryption key. As shown in FIG. **8**, the data entry means **47** contains the keyed algorithm and upon entry of the key **49**, the data will be encoded into a two-dimensional graphic pattern in a unique configuration. The unique configuration can only be read by a reader **48** having the algorithm and only upon entry of the key **49** into the reader. Thus, a high degree of security may be provided with the keyed encryption embodiment.

In addition, the recognition unit **40** may also transmit the output signals to a central processing unit locally or remotely, by for example a modem, for further use or processing by the CPU. In this embodiment, the data encoded onto the carrier means **18** may be control data in the form of machine operating instructions for controlling a robotic system or to a security identification system for performing such functions as unlocking doors. In connection with the use of the present invention in a robotic system, it is contemplated that the two-dimensional graphic pattern containing the control data be placed or printed directly onto a machine part or part holder. A scanner coupled to the machine tool reeds the pattern and transmits the decoded instruction to the control computer which in turn controls the machining of the part in accordance with the control program. Another example of the use of the present invention includes a microwave food container where the two-dimensional graphic pattern contains instructions automatically entering the recommended cooking sequence. A further use may be in connection with placing on roadway signs two-dimensional patterns containing geographic location information that may be read by a scanner in passing vehicles for use with onboard computers.

The present invention further contemplates the use of the system of the present invention to encode control data containing machine operating instructions onto the carrier means in the form of machine readable graphic indicia that may be inserted into the machine to effect operation of the machine. FIG. **9** is an example of a facsimile machine **50** in which a document **52** containing human readable data **54** and a two-dimensional pattern of graphic machine readable indicia **56**. The document **52** is inserted into the facsimile machine **50** the same as documents are normally inserted for transmission. The machine **50** contains a converting means for converting the two-dimensional image into electrical signals and a decoding means for decoding the signals into output signals operative to actuate the facsimile machine **50**. The pattern **56** may contain such information as the phone number of the intended recipient of the memo **54** and the appropriate instructions for automatically entering the phone number and actuating the transmission process. Thus, where numerous messages are faxed to a particular recipient, a supply of paper containing the phone number of the recipient encoded in the two-dimensional graphic indicia machine readable format may be maintained by the sender. The transmission of messages to that recipient will be facilitated by placing the message onto the pre-encoded paper and simply inserting the paper into the facsimile machine. In addition to simplifying and speeding the transmission process, the possibility of sending highly sensitive information to an incorrect party will also be eliminated.

Scanning/Decoding Apparatus

Referring now to FIG. **10**, there is illustrated a further embodiment of the recognition means **14** for scanning and decoding graphic indicia in machine readable form, where that graphic indicia is in the form of a two-dimensional bar code symbol such as PDF417 . As shown in FIG. **10**, the recognition means **14** includes a host computer **112**, which may be a personal computer, a low-level decoder **114**, and a hand-held laser scanner **116**. Scanner **116** uses a laser light beam **118** to scan a two-dimensional bar code symbol **120** in a raster pattern while a trigger **122** is pulled. A laser scanner suitable for scanning a two-dimensional bar code symbol is disclosed in U.S. patent application Ser. No. 07/317,433 filed Mar. 1, 1989, and assigned to the same assignee as the present invention, which is hereby incorporated by reference.

Electrical signals from laser scanner **114** are transmitted to low-level decoder **114** where they are decoded into a matrix of codeword values corresponding to the rows and columns of the two-dimensional bar code symbol. As explained in further detail below, low-level decoder **114** may be embodied in a computer program operating on a micro-computer separate from the host computer. The low-level decoder is connected to the host computer by a standard interface, such as an RS-232 interface, for transmitting the codeword values after they are decoded. Alternatively, the low-level decoder **114** may be embodied entirely in hardware, or a combination of a hardware and software, which is physically located in either the scanner itself or the host computer.

The matrix of codeword values from low-level decoder **114** is decoded into usable data by a high-level decoder, which may be embodied as a separate computer program operating on the host computer **112**. For example, PDF417 has three predefined modes and nine reserved modes. The predefined modes are Binary, EXC, and Numeric. In the Binary mode, each codeword can encode 1.2 bytes. In the EXC mode, the alphanumeric data can be encoded in double density (i.e., two characters per code word), and in Numeric mode, the numeric data can be packed in almost triple density. Therefore, the high-level decoder in host computer **112** will further decode the codeword values **(0–928)** from low-level decoder **114**, depending on the mode, to obtain the actual data embodied in the symbol. The decoded data from the high-level decoder may then be used by a user application program also operating on the host computer **112**.

Low-Level Decoder

FIG. **11** is a schematic block diagram of one embodiment of the hardware apparatus of low-level decoder **114** shown in FIG. **10**. In this embodiment, the low-level decoder is primarily embodied in a computer program which is executed by a microcomputer separate from the host computer.

As shown in FIG. **11**, the low-level decoder includes a scanner interface **130** which receives the electrical signals from the scanner. The electrical signals from the scanner may be in the form of a digital signal which corresponds to the light and dark elements of the symbol as it is being scanned. Scanner interface **130** converts the electrical signals into a sequence of integer values representing the varying widths of the bars and spaces and stores them in a buffer area of a memory **134**. In order to accomplish this, scanner interface **130** is connected to a central bus **132** to which the other hardware elements of the low-level decoder are also connected. Scanner interface **130** has direct memory access (DMA) capability which allows it to store the converted scanner data directly in the memory for decoding.

Low-level decoder also includes a central processing unit (CPU) **136** and a second interface **138** for communicating with the host computer. The interface to the host computer may be one or more standard interfaces such as an RS-232 interface.

FIG. **12** is a flow chart showing the sequence of operation of the low-level decoder for decoding a two-dimensional bar code symbol such as PDF417 into a matrix of codeword values. The various steps in the sequence are embodied in a software computer program which is stored in memory **134** and executed by CPU **136** shown in FIG. **11**.

In the first step **150** in FIG. **12**, the low-level decoder initializes the scanner interface and initiates scanning of the symbol. The actual functions performed in this step will depend on the type of scanner and will involve various scanner dependent routines to initialize the scanner interface and to start scanning.

In step **152**, the low-level decoder attempts to determine the dimensions and the security level of the symbol being scanned. Specifically, this step determines the number of rows, the number of data columns, and the security level of the symbol from the left and right row indicator codewords. These dimensions are then used to initialize a two-dimensional codeword matrix and other related parameters for decoding the symbol. Each location in the matrix contains both a codeword value and an associated confidence weight, which are initially set to a null or empty value. If the dimensions and security level of the symbol cannot be determined, then the scan

is aborted. This step will be discussed in further detail below in connection with FIG. 13.

Continuing in FIG. 12, step **154** is the first step in a control loop in which the rows of the two-dimensional bar code symbol are repeatedly scanned and the codeword values are filled into the codeword matrix. The steps of the control loop are each repeated until the number of codewords remaining in the matrix which have not been successfully decoded is small enough that rest of the matrix can be determined using the built-in error correction capability of the symbol. Thus, in step **154**, if the number of codewords which have not been successfully decoded is less than the error correction capability of the symbol based on the security level (see FIG. 4), an attempt is made to correct the matrix using the error-correction codewords. If the attempted error correction is successful, then in step **156**, the control loop is exited and scanning is terminated in step **158**. Otherwise, if the attempted error correction is not successful, then the following steps **160–164** are performed to try to decode additional codewords to fill in the matrix.

First, step **160** searches a scan line of data obtained from the buffer area of the memory for a start or a stop pattern. If either a start or a stop pattern is found, then in step **162**, the low-level decoder attempts to decode as many codewords as possible from the scan line. Specifically, the scan line of data is parsed into individual codewords whose values and cluster numbers are placed in a codeword vector ready for incorporation into the codeword matrix. Both steps **160** and **162** are discussed in further detail below in connection with FIGS. **14** and **16**, respectively.

The codeword vector produced in step **162** is analyzed and then used to update the codeword matrix in step **164**. In particular, step **164** assigns a confidence weight to each codeword value depending on whether its nearest neighbors were also decoded. Row numbers are also assigned to each codeword value based on the left or right row indicator codewords and the corresponding cluster number for the codeword. If the scan line crosses a row boundary, the cluster numbers of the codewords can be used to determine the correct row number for each individual codeword. For example, if a decoded scan line has a left row indicator with row number **2**, and the cluster numbers of the following codewords are **6, 0, 0, 3**, the codewords are accordingly placed in the following locations: (row **2**, column **1**); (row **3**, column **2**); (row **3**, column **3**); and (row **4**, column **4**). In this way, a single scan line of data can contain codewords from more than one row, which can then be stitched into the appropriate location in the codeword matrix. This step is discussed in further detail in connection with FIGS. **19A** and **19B** below.

FIG. **13** is a flow chart showing in greater detail the sequence of steps for determining the dimensions and security level of a symbol as referred to in step **152** of FIG. **12** above. In the first step **170** of FIG. **13**, the low-level decoder searches a scan line of data obtained from the buffer area of the memory for a start or a stop pattern. This step is the same as step **160** in FIG. **12** and is discussed in further detail in connection with FIG. **14** below.

Step **172** then decodes the first codeword immediately adjacent to either the start or stop pattern found in the previous step. As shown in FIG. **3**, this codeword will be either a left or right row indicator codeword containing the row number and either the number of rows, the number of data columns, or the security level of the symbol. If both a start and a stop pattern are found, then both the left and the right row indicators are decoded. The sequence of steps for decoding an individual codeword are discussed further below in connection with FIG. **18**.

Continuing in FIG. **13**, in step **174** the particular dimension or security level encoded in the row indicator is extracted from the codeword value and the cluster number determined in the previous step **172**. For example, for a left row indicator codeword with a cluster number of **0**, the number of rows is extracted from the codeword value.

A confidence weight assigned to each of the dimensions and the security level is initially set to 0. Steps **176–184** update both the current value and the confidence weight of the dimension or security level extracted in the previous step in the following way. First, the particular parameter, say the number of rows, is compared to the current value of the number of rows obtained from previous decodes. If the current value of the number of rows and the newly decoded value are the same, as determined in step **176**, then the confidence weight assigned to the number of rows is increased in step **178**. If the current value and the newly decoded value are different, however, then the confidence weight is decreased in step **180**. If the confidence weight assigned to the particular parameter is decreased below zero as determined in step **182**, then the newly decoded value is substituted for the current value and a new minimum weight is assigned to the parameter in step **184**.

Step **186** determines whether the confidence weight for all three parameters, i.e., number of rows, number of data columns, and security level, exceeds a predetermined threshold. If so, then the two-dimensional codeword matrix is initialized in step **188** based on the current values of the number of rows and the number of columns. The number of correctable errors may also be determined from the current value of the security level according to the table in FIG. **4**. If all three confidence weights do not exceed the threshold in step **186**, however, then program control returns to step **170** to begin searching for the start and stop patterns in a new scan line. Steps **170–184** are repeated until all three parameters have been successfully decoded with a high degree of confidence.

FIG. **14** is a flow chart showing in greater detail the sequence of steps for searching a scan line of data for a start or stop pattern as referred to above in step **160** of FIG. **12** and step **170** of FIG. **13**. Briefly, the search begins at the first location of an individual scan line of data obtained from the buffer area of the memory and is repeated at sequential locations until either a match is found or the length of the scan line is exceeded. When a match is found, an index is set to a location immediately following or preceding the pattern for decoding the adjacent code word.

As shown in FIG. **14**, the first step **200** sets an index to the location of the data elements in the scan line to "1", indicating the first data element or integer value of the scan line. This index is used to identify the first element of each sequence of eight elements in the scan line for comparison to the start and stop patterns.

Step **202** is the first step of an iterative loop for searching the scan line from left to right for either a start or a stop pattern. In this step, if the current index is less than the length of the scan line, then the remain-

ing steps are executed and the search continues. Once the index exceeds the length of the scan line, however, then the loop is exited and an indication is returned signifying that the search failed and a start or stop pattern was not found.

Rather than using the X-sequence of codeword, the low-level decoder decodes a symbol by using "edge to similar edge" measurements to compensate for ink spreading which occurs when printing the symbols. Thus, in step **204**, a raw "t-sequence" is obtained from the scan line by adding pairs of consecutive integer values beginning at the location specified by the index. Specifically, the raw t-sequence, which corresponds to the seven width measurements $t_1, t_2, \ldots t_7$ shown in FIG. **15**, is calculated by adding pairs of the consecutive integer values $x_0, x_1, \ldots x_7$, representing the widths of the bars and spaces, as follows:

$$t_1 = x_0 + x_1$$

$$t_2 = x_1 + x_2$$

$$t_3 = x_2 + x_3$$

etc

A width W for the entire codeword is also calculated in step **204** by summing the eight integer values $x_0 + x_1 + \ldots + x_7$.

For the codeword in FIG. **15**, for example, the sequence of integer values from the scan line, representing the widths of the bars and spaces might be something like: **43, 19, 21, 19, 22, 18, 103, 96**. The raw t-sequence $t_1, t_2, \ldots t_7$ would then be **62, 40, 40, 41, 40, 121, 199**, and the width W would be **341**.

In step **206** in FIG. **14**, the raw t-sequence obtained in step **204** is normalized and rounded to integer values. Specifically, a value for the codeword's "module" or "unit" is first established by dividing the width W of the codeword by the total number of units for each codeword. In a PDF417 symbol, each codeword is seventeen units, so that the width W is divided by seventeen to obtain the unit of the codeword. Thus, for the example in FIG. **15**, the unit would be (341/17)=20.0. Each value of the raw t-sequence is then divided by the unit and rounded to an integer to normalize the t-sequence. The normalized t-sequence for the codeword in FIG. **15** is **3, 2, 2, 2, 6, 10**.

The normalized t-sequence is then compared to the t-sequences of the start and stop patterns of the code in step **208**. If the scanner scans from both left to right and right to left, then the t-sequence must be compared to the start and stop patterns in both their normal and reverse orientations.

If there is a match in step **210**, then the index is set in step **214** to a location in the scan line immediately following the pattern if it is a start pattern or immediately preceding it if it is a stop pattern. If the current t-sequence does not match either the start or the stop pattern, however, then in step **212**, the index is incremented by one and steps **202** through **210** are repeated until either a match is found or the length of the scan line is exceeded.

FIG. **16** is a flow chart showing in greater detail the sequence of steps for decoding a scan line of data into a vector of codewords and their clusters as referred to in step **162** of FIG. **12** above. In decoding the individual codeword values and cluster numbers from the scan line, the low-level decoder begins decoding at the start or stop pattern and decodes as many codewords possible. For those codewords that are not successfully decoded, the codeword values in the codeword vector are set to "BAD".

At the completion of the sequence of steps shown in FIG. **16**, the codeword vector will contain certain codeword values and cluster numbers in locations corresponding to the appropriate columns of the codewords that were successfully decoded. FIG. **17A** shows an example of a codeword vector in which the codewords in eight of the ten columns were successfully decoded. The codeword values in columns **1** and **10** correspond to the left row indicator codeword in row **2** (L_2) and the right row indicator codeword in row **1** (R_1), respectively. The codewords in columns **5** and **7** were not successfully decoded as indicated by the notation "BAD" in those locations of the codeword vector.

Returning to the first step **220** of FIG. **16**, an upper limit on the number of codewords that may be decoded ("cwlimit") is set equal to the number of columns in the codeword matrix. If this number of codewords is successfully decoded, then the decoding process for the current scan line is obviously complete.

Step **222** determines the direction of the scan if the scanner scans from both left to right and right to left. If the particular scan was from left to right as determined in step **222**, then the column number of the first codeword is set to "1" in step **224** and the amount that it will incremented by ("incr") each time a subsequent codeword is decoded is set to "+1". If the scan was from right to left, however, then in step **226**, the column number of the first codeword in the scan line will be the last column of the codeword matrix, and the incremental value is set to "−1".

Step **228** is the first step of a control loop in which individual codeword values and their cluster numbers are decoded from the scan line of data. In step **228**, the codeword limit is tested to see if it is still greater than zero. If not, then all of the codewords in the scan line have been decoded and the loop is exited.

Otherwise, step **230** obtains the next codeword value and its cluster number from the scan line. This step will be discussed in further detail below in connection with FIG. **18**.

If the codeword decoded in the previous step is a valid codeword as determined in step **232**, then in step **234** the codeword value and its cluster number are saved in the codeword vector at a location corresponding to the column of the codeword. The codeword values thus placed in the codeword vector are ready for incorporation into the codeword matrix.

If the codeword decoded in step **230** is not a valid codeword, however, then the codeword value in the codeword vector corresponding to the current column is set to "BAD" in step **236** to indicate that this codeword was not successfully decoded. A "BAD" codeword is most likely to occur when the scan line crosses the boundary between two rows in the middle of the codeword.

Finally, in step **238**, the current column number is either incremented or decremented depending on the direction of the scan, and the codeword limit is decremented by one. Steps **228**–**236** are then repeated until there has been an attempt to decode all of the codewords in the scan line.

FIG. **18** is a flow chart diagram showing the sequence of steps corresponding to step **230** in FIG. **16**

and step **172** in FIG. **13** in which an attempt is made to decode an individual codeword value and cluster number from the scan line. In the first step **240**, a raw t-sequence and the width W are obtained from the scan line. This same step was discussed previously in connection with step **204** in FIG. **14**.

In step **242**, the width W of the eight elements presumed to be the next codeword are compared to the width of the previously decoded codeword. If the current width W is not within a range of plus or minus a predetermined difference (delta), then there is probably a split (undercount by a multiple of two elements) or a merge (overcount by a multiple of two elements) error in the current codeword. This codeword is not decoded further, but rather in step **244** its value and cluster number are both set to BAD to indicate that it could not be decoded.

Then in step **246**, an attempt is made to resynchronize to the boundary of the next codeword by finding a t-sequence with a corresponding width W that falls within a given tolerance of the expected width of a codeword, based on the width of the previous codeword. If the current width W is significantly greater than the expected width, indicating a possible merge error, then the last two integer values are dropped from the t-sequence until it falls within the proper limits. Likewise, if the current width W is significantly less than the expected width, indicating a possible split error, the next two integer values in the scan line are added to the t-sequence until it falls within the proper limits.

If the current width W is within a certain tolerance of the expected width, as determined in step **242**, then an attempt is made to decode the codeword. In step **248**, the raw t-sequence is normalized as described above in connection with step **206** in FIG. **14**. Then in step **250**, the cluster number is determined from the normalized t-sequence. The cluster number may be determined from the t-sequence (as opposed to the X-sequence described above) as follows:

$$\text{cluster number} = (T_1 - T_2 + T_5 - T_6) \bmod 9$$

For codewords in PDF417, valid cluster numbers are **0**, **3**, and **6**. If in step **252** it is determined that the cluster number is not **0**, **3**, or **6**, then the codeword is not valid. Accordingly, in step **254** the cluster number and value are set to "BAD" to indicate that the codeword was not successfully decoded.

Otherwise, in step **256**, the normalized t-sequence and its cluster number are used to find the corresponding codeword value in a look-up table. If no corresponding codeword value is found for the t-sequence, then the codeword value is set to "BAD" to indicate that it was not successfully decoded.

Finally, in step **258** the "last width" value is updated to the current width W of the codeword for use in decoding the next codeword value from the scan line.

FIGS. **19A** and **19B** together comprise a flow chart of the sequence of steps executed by the low-level decoder in order to update the codeword matrix using the codeword vector. These figures explain in greater detail step **164** in FIG. **12** discussed previously.

The first step **260** of FIG. **19A** checks the first and last values in the codeword vector to see if either is a valid row indicator. If neither the first nor the last values in the codeword vector are valid row indicators, then in step **262**, the program exits the routine and no attempt is made to update the codeword matrix using the codeword vector.

If a valid row indicator is present, however, then in step **264** confidence weights are assigned to each codeword value in the codeword vector. Specifically, a confidence weight is assigned to each codeword depending on whether its nearest neighbors and their cluster were also decoded. For example, as shown in FIG. **17B**, the codeword values in columns **1**, **2**, **3**, **9**, and **10** are assigned high confidence weights ("H") because their immediate neighbors were also successfully decoded and have the same cluster number. The codeword values for columns **4** and **8** are assigned medium confidence weights ("M") because one of their neighbors was successfully decoded and has the same cluster number but the other neighboring codeword value is "BAD". The codeword value in column **3** is assigned a very low confidence weight ("L") because neither of its neighbors was successfully decoded. Thus, the confidence weight for a codeword value at column i in the codeword vector is essentially a function of the cluster numbers of the codewords at columns $i-1$, i, and $i+1$. This function may be implemented by a look-up table whose index is calculated from the cluster numbers of the three codewords.

In step **266**, a row number is assigned to each codeword value in the codeword vector based on the row indicator codewords and the cluster numbers. As shown in the example in FIG. **17C**, the left row indicator codeword L_2 indicates that the row number is **2** and the cluster number is **6**. The cluster numbers for the codeword values in columns **2–4** are also **6**. Therefore, row number **2** is assigned to the codeword values in the first four columns of the codeword vector.

Also in the example in FIG. **17C**, columns six and **8–10** all have a cluster number of **3** and the right row indicator codeword R_1 indicates that the row number is **1**. Therefore, it can be assumed that the scan line crossed the row boundary between row **2** and row **1** and the codeword values in columns **6** and **8–10** should be assigned to row **1**.

Once the confidence weights and row numbers have been assigned to each of the codeword values in the codeword vector, the codeword matrix is updated one codeword at a time. In step **268**, the column number C of both the codeword vector and the codeword matrix is set is initially set to "1". Step **270** is the first step of an iterative loop which steps through the codewords in the codeword vector and uses them to update the corresponding codewords and their associated confidence weights in the codeword matrix. When the column number C exceeds the number of columns in step **270**, then all of the codewords in the codeword vector have been processed and the routine ends.

For each codeword in the codeword vector, step **272** sets the row number R of the codeword matrix to the row number assigned in step **266** to the codeword in the codeword vector at the location C. Thus, for each codeword value in the codeword vector, there is a corresponding value in the codeword matrix at location [R,C].

Continuing in FIG. **19B**, step **274** determines whether the current codeword value in location [R,C] in the codeword matrix is the same as the corresponding codeword value in the codeword vector at column C. If the values are the same, then in step **276**, the confidence weight assigned to the codeword value in matrix location [R,C] is increased by the confidence weight of the

corresponding codeword value in the codeword vector. If not, the confidence weight of the codeword value in the matrix is decreased by the confidence weight of the codeword value in the vector in step **278**.

If the confidence weight was decreased in step **278**, then in step **280** that confidence weight is tested to see if it was decreased below zero. If the confidence weight is less than zero, then in step **282** the new codeword value in the codeword vector is substituted for the current codeword value in the corresponding location in the codeword matrix. The confidence weight assigned to the codeword value in the matrix is also changed to a positive value in step **284**.

Finally, in step **286** the column number C is incremented by **1** for processing the next codeword value in the codeword vector and program control is returned to step **270** for repeating steps **272** through **286** for all of the columns in the vector.

Returning briefly to step **154** in FIG. **12**, each time after the codeword matrix has been filled in with the new vector of codeword values and the confidence weights have been updated, an attempt is made to fill in the rest of the matrix using the built-in error correction capability of the symbol. The number and location of codewords which have not yet been successfully decoded may be determined by comparing the confidence weights assigned to each of the codeword values in the matrix with a predetermined threshold. Those values having confidence weights below the threshold are considered to not yet be decoded. If the number of codewords not yet decoded is less than the error correction capability of the symbol as determined by the security level, then an attempt is made to correct the matrix.

It will be apparent to those skilled in the art that various modifications and variations can be made in the decoding method and apparatus without departing from the scope or spirit of the invention. Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.

What is claimed is:

1. An apparatus for decoding a two-dimensional bar code symbol, the bar code symbol including a plurality of ordered, adjacent rows of codewords of bar-coded information from a set of codewords, the set of codewords being partitioned into at least three mutually exclusive clusters, each row in the symbol having at least one row indicator codeword and containing only codewords from a cluster different from the codewords in an adjacent row, comprising:

means for scanning the two-dimensional bar code symbol to produce scan lines of data representing the bar-coded information in the codewords of the symbol;

means for decoding a scan line of data into a vector of codeword values corresponding to the codewords that were scanned, at least one of the codeword values being for a row indicator codeword;

means for assigning a row number to each of the codeword values in the vector based on the value of the row indicator codeword and the cluster of the codeword; and

means for filling in a codeword matrix with the codeword values in the vector according to their assigned row numbers.

2. The apparatus of claim **1**, wherein the row indicator codewords contain information regarding the number of rows in the symbol and the number of codewords in each row, and wherein the apparatus further comprises

means for decoding a scan line of data to obtain a codeword value for a row indicator codeword, and

means for determining one of the number of rows and the number of codewords in each row from the codeword value for the row indicator codeword.

3. The apparatus of claim **2**, wherein each row of the symbol contains at least one of a start pattern and a stop pattern of bar-coded information, wherein the means for decoding a scan line of data to obtain a codeword value for a row indicator codeword includes means for locating a sequence of data in the scan line corresponding to one of the start pattern and the stop pattern.

4. The apparatus of claim **1**, wherein the symbol contains at least one error correction codeword and the row indicator codewords contain information regarding the number of rows in the symbol, the number of codewords in each row, and the number of error correction codewords, and wherein the apparatus further comprises

means for decoding a scan line of data to obtain a codeword value for a row indicator codeword,

means for determining a value for one of the number of rows, the number of codewords in each row, and the number of error correction codewords from the codeword value for the row indicator codeword,

means for adjusting a confidence weight for a corresponding one of the number of rows, the number of codewords in each row, and the number of error correction codewords based on the value determined in the preceding step and a previous value obtained by decoding a row indicator codeword, and

means for initializing the codeword matrix when the confidence weights for the number of rows, the number of codewords in each row, and the number of error correction codewords all exceed a predetermined threshold.

5. The apparatus of claim **4**, wherein each row of the symbol contains at least one of a start pattern and a stop pattern of bar-coded information, and wherein the means for decoding a scan line of data to obtain a codeword value for row indicator codeword includes means for locating a sequence of data in the scan line corresponding to one of the start pattern and the stop pattern.

6. The apparatus of claim **1**, wherein each row of the symbol contains at least one of a start pattern and a stop pattern of bar-coded information, and wherein the means for decoding a scan line of data into a vector of codeword values includes means for locating a sequence of data in the scan line corresponding to one of the start pattern and the stop pattern.

7. The apparatus of claim **1**, further comprising

means for assigning a confidence weight to each of the codeword values in the vector, and

means for adjusting a confidence weight of each of the corresponding codeword values in the matrix based on the codeword value in the vector and a current value of each of the corresponding codeword values in the matrix.

8. The apparatus of claim 1, wherein the symbol contains at least one error correction codeword, and wherein the apparatus further comprises

means for locating in the matrix the codeword values for any codewords that have not been successfully decoded, and

means for correcting any erroneous codeword values in the codeword matrix using the error correction codeword.

9. A method for decoding a two-dimensional bar code symbol, the bar code symbol including a plurality of ordered, adjacent rows of codewords of bar-coded information from a set of codewords, the set of codewords being partitioned into at least three mutually exclusive clusters, each row in the symbol having at least one row indicator codeword and containing only codewords from a cluster different from the codewords in an adjacent row, comprising the steps of:

scanning the two-dimensional bar code symbol to produce scan lines of data representing the bar-coded information in the codewords of the symbol;

decoding a scan line of data into a vector of codeword values corresponding to the codewords that were scanned, at least one of the codeword values being for a row indicator codeword;

assigning a row number to each of the codeword values in the vector based on the value of the row indicator codeword and the cluster of the codeword; and

filling in a codeword matrix with the codeword values in the vector according to their assigned row numbers.

10. The method of claim 9, wherein the row indicator codewords contain information regarding the number of rows in the symbol and the number of codewords in each row, and wherein the method further comprises the steps of

decoding a scan line of data to obtain a codeword value for a row indicator codeword, and

determining one of the number of rows and the number of codewords in each row from the codeword value for the row indicator codeword.

11. The method of claim 10, wherein each row of the symbol contains at least one of a start pattern and a stop pattern of bar-coded information, and wherein the step of decoding a scan line of data to obtain a codeword value for a row indicator codeword includes the substep of locating a sequence of data in the scan line corresponding to one of the start pattern and the stop pattern.

12. The method of claim 9, wherein the symbol contains at least one error correction codeword and the row indicator codewords contain information regarding the number of rows in the symbol, the number of codewords in each row, and the number of error correction codewords, and wherein the method further comprises the steps of

decoding a scan line of data to obtain a codeword value for a row indicator codeword,

determining a value for one of the number of rows, the number of codewords in each row, and the number of error correction codewords from the codeword value for the row indicator codeword,

adjusting a confidence weight for a corresponding one of the number of rows, the number of codewords in each row, and the number of error correction codewords based on the value determined in the preceding step and a previous value obtained by decoding a row indicator codeword, and

initializing the codeword matrix when the confidence weights for the number of rows, the number of codewords in each row, and the number of error correction codewords all exceed a predetermined threshold.

13. The method of claim 12, wherein each row of the symbol contains at least one of a start pattern and a stop pattern of bar-coded information, and wherein the step of decoding a scan line of data to obtain a codeword value for a row indicator codeword includes the substep of locating a sequence of data in the scan line corresponding to one of the start pattern and the stop pattern.

14. The method of claim 9, wherein each row of the symbol contains at least one of a start pattern and a stop pattern of bar-coded information, and wherein the step of decoding a scan line of data into a vector of codeword values includes the substep of locating a sequence of data in the scan line corresponding to one of the start pattern and the stop pattern.

15. The method of claim 9, further comprising the steps of

assigning a confidence weight to each of the codeword values in the vector,

adjusting a confidence weight of each of the corresponding codeword values in the matrix based on the codeword value in the vector and a current value of each of the corresponding codeword values in the matrix.

16. The method of claim 9, wherein the symbol contains at least one error correction codeword, and wherein the method further comprises the steps of

locating in the matrix the codeword values for any codewords that have not been successfully decoded, and

correcting any erroneous codeword values in the codeword matrix using the error correction codeword.

17. A system for representing and recognizing data on a record carrier in the form of a machine readable two-dimensional bar code structure comprising:

encoding means including:

means for entering data in said encoding means,

processing means for encoding said data into a two-dimensional bar code structure and for generating transfer drive signals, the bar code structure including a plurality of ordered, adjacent rows of codewords of bar-coded information from a set of codewords, the set of codewords being partitioned into at least three mutually exclusive clusters, each row in the two-dimensional bar code structure having at least one row indicator codeword and containing only codewords from a cluster different from the codewords in an adjacent row,

means for transferring an image of the two-dimensional bar code structure onto a portable record carrier in response to said transfer drive signals; and

recognition means including:

means for scanning the image of the two-dimensional bar code structure to produce scan lines of data representing the bar-coded information in the codewords of the two-dimensional bar code structure,

means for decoding a scan line of data into a vector of codeword values corresponding to the codewords that were scanned, at least one of the

codeword values being for a row indicator codeword,

means for assigning a row number to each of the codeword values in the vector based on the values of the row indicator codeword and the cluster of the codeword, and

means for filling in a codeword matrix with the codeword values in the vector according to their assigned row numbers.

18. The system of claim **17**, wherein the row indicator codewords contain information regarding the number of rows in the two-dimensional bar code structure and the number of codewords in each row, and wherein the recognition means further includes

means for decoding a scan line of data to obtain a codeword value for a row indicator codeword, and

means for determining one of the number of rows and the number of codewords in each row from the codeword value for the row indicator codeword.

19. The system of claim **18**, wherein each row of the two-dimensional bar code structure contains a start and a stop pattern of bar-coded information, and wherein the means for decoding a scan line of data to obtain a codeword value for a row indicator codeword includes means for locating a sequence of data in the scan line corresponding to one of the start and the stop pattern.

20. The system of claim **17**, wherein the two-dimensional bar code structure contains at least one error correction codeword and the row indicator codewords contain information regarding the number of rows in the two-dimensional bar code structure, the number of codewords in each row, and the number of error correction codewords, and wherein the recognition means further includes

means for decoding a scan line of data to obtain a codeword value for a row indicator codeword,

means for determining a value for one of the number of rows, the number of codewords in each row, and the number of error correction codewords from the codeword value for the row indicator codeword,

means for adjusting a confidence weight for a corresponding one of the number of rows, the number of codewords in each row, and the number of error correction codewords based on the value determined in the preceding step and a previous value obtained by decoding a row indicator codeword, and

means for initializing the codeword matrix when the confidence weights for the number of rows, the number of codewords in each row, and the number of error correction codewords all exceed a predetermined threshold.

21. The system of claim **20**, wherein each row of the two-dimensional bar code structure contains a start and a stop pattern of bar-coded information, and wherein the means for decoding a scan line of data to obtain a codeword value for a row indicator codeword includes means for locating a sequence of data in the scan line corresponding to one of the start and the stop pattern.

22. The system of claim **17**, wherein each row of the two-dimensional bar code structure contains a start and a stop pattern of bar-coded information, and wherein the means for decoding a scan line of data to obtain a codeword value for a row indicator codeword includes means for locating a sequence of data in the scan line corresponding to one of the start and the stop pattern.

23. The system of claim **17**, wherein the recognition means further includes

means for assigning a confidence weight to each of the codeword values in the vector, and

for adjusting a confidence weight of each of the corresponding codeword values in the matrix based on the codeword value in the vector and a current value of each of the corresponding codeword values in the matrix.

24. The system of claim **17**, wherein the two-dimensional bar code structure contains at least one error correction codeword, and wherein the recognition means further includes

means for locating in the matrix the codeword values for any codewords that have not been successfully decoded, and

means for correcting any erroneous codeword values in the codeword matrix using the error correction codeword.

25. A method for representing and recognizing data on a record carrier in the form of a machine readable two-dimensional bar code structure comprising the steps of:

entering said data into an encoding station;

encoding said data into a two-dimensional bar code structure, the two-dimensional bar code structure including a plurality of ordered, adjacent rows of codewords of bar-coded information from a set of codewords, the set of codewords being partitioned into at least three mutually exclusive clusters, each row in the two-dimensional bar code structure having at least one row indicator codeword and containing only codewords from a cluster different from the codewords in an adjacent row,

transferring an image of the two-dimensional bar code structure onto a portable record carrier;

scanning the image of the two-dimensional bar code structure to produce scan lines of data representing the bar-coded information in the codewords;

decoding a scan line of data into a vector of codeword values corresponding to the codewords that were scanned, at least one of the codeword values being for a row indicator codeword;

assigning a row number to each of the codeword values in the vector based on the value of the row indicator codeword and the cluster of the codeword; and

filling in a codeword matrix with the codeword values in the vector according to their assigned row numbers.

26. The method of claim **25**, wherein the row indicator codewords contain information regarding the number of rows in the two-dimensional bar code structure and the number of codewords in each row, and wherein the method further comprises the steps of

decoding a scan line of data to obtain a codeword value for a row indicator codeword, and

determining one of the number of rows and the number of codewords in each row from the codeword value for the row indicator codeword.

27. The method of claim **26**, wherein each row of the two-dimensional bar code structure contains a start and a stop pattern of bar-coded information, and wherein the step of decoding a scan line of data to obtain a codeword value for a row indicator codeword includes the substep of locating a sequence of data in the scan line corresponding to one of the start and the stop pattern.

28. The method of claim **25**, wherein the two-dimensional bar code structure contains at least one error correction codeword and the row indicator codewords contain information regarding the number of rows in the two-dimensional bar code structure, the number of codewords in each row, and the number of error correction codewords, and wherein the method further comprises the steps of

decoding a scan line of data to obtain a codeword value for a row indicator codeword,

determining a value for one of the number of rows, the number of codewords in each row, and the number of error correction codewords from the codeword value for the row indicator codeword,

adjusting a confidence weight for a corresponding one of the number of rows, the number of codewords in each row, and the number of error correction codewords based on the value determined in the preceding step and a previous value obtained by decoding a row indicator codeword, and

initializing the codeword matrix when the confidence weights for the number of rows, the number of codewords in each row, and the number of error correction codewords all exceed a predetermined threshold.

29. The method of claim **25**, wherein each row of the two-dimensional bar code structure contains a start and a stop pattern of bar-coded information, and wherein the step of decoding a scan line of data to obtain a codeword value for a row indicator codeword includes the substep of locating a sequence of data in the scan line corresponding to one of the start and the stop pattern.

30. The method of claim **25**, wherein each row of the two-dimensional bar code structure contains a start and a stop pattern of bar-coded information, and wherein the step of decoding a scan line of data into a vector of codeword values includes the substep of locating a sequence of data in the scan line corresponding to one of the start and the stop pattern.

31. The method of claim **25**, further comprising the steps of

assigning a confidence weight to each of the codeword values in the vector,

adjusting a confidence weight of each of the corresponding codeword values in the matrix based on the codeword value in the vector and a current value of each of the corresponding codeword values in the matrix.

32. The method of claim **25**, wherein the two-dimensional bar code structure contains at least one error correction codeword, and wherein the method further comprises the steps of

locating in the matrix the codeword values for any codewords that have not been successfully decoded, and

correcting any erroneous codeword values in the codeword matrix using the error correction codeword.

* * * * *

Exhibit 8

INTERNATIONAL STANDARD

ISO/IEC 15438

Third edition
2015-09-15

Information technology — Automatic identification and data capture techniques — PDF417 bar code symbology specification

Technologies de l'information — Techniques automatiques d'identification et de capture des données — Spécifications pour la symbologie de code à barres PDF417

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*

This third edition cancels and replaces the second edition (ISO/IEC 15438:2006), of which it constitutes a minor revision.

Introduction

The technology of bar coding is based on the recognition of patterns of bars and spaces of defined dimensions. There are various methods of encoding information in bar code form, known as symbologies, and the rules defining the translation of characters into bars and space patterns and other essential features are known as the symbology specification.

Manufacturers of bar code equipment and users of bar code technology require publicly available standard symbology specifications to which they can refer when developing equipment and application standards. It is the intent and understanding of ISO/IEC that the symbology presented in this International Standard is entirely in the public domain and free of all user restrictions, licences and fees.

Information technology — Automatic identification and data capture techniques — PDF417 bar code symbology specification

1 Scope

This International Standard specifies the requirements for the bar code symbology known as PDF417. It specifies PDF417 symbology characteristics, data character encodation, symbol formats, dimensions, error correction rules, reference decoding algorithm, and a number of application parameters.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 646, *Information technology — ISO 7-bit coded character set for information interchange*

ISO/IEC 15415, *Information technology — Automatic identification and data capture techniques — Bar code symbol print quality test specification — Two-dimensional symbols*

ISO/IEC 15424, *Information technology — Automatic identification and data capture techniques — Data Carrier Identifiers (including Symbology Identifiers)*

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*

ISO/IEC 19762-2, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 2: Optically readable media (ORM)*

ISO/IEC 24723, *Information technology — Automatic identification and data capture techniques — GS1 Composite bar code symbology specification*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC19762-1, ISO/IEC 19762-2 and the following apply.

3.1
basic channel model
standard system for encoding and transmitting bar code data where data message bytes are output from the decoder but no control information about the message is transmitted

Note 1 to entry: A decoder complying with this model operates in Basic Channel Mode.

3.2
bar-space sequence
sequence which represents the module widths of the elements of a symbol character

3.3
cluster
any of the three mutually exclusive subsets of PDF417 symbol characters

Note 1 to entry: The symbol characters in a given cluster conform with particular structural rules which are used in decoding the symbology.

3.4
compaction mode
any of the three data compaction algorithms in PDF417 (Text, Numeric and Byte Compaction modes) which are used to map 8-bit data bytes efficiently to PDF417 codewords

3.5
e-distance
distance from the leading edge of an element to the leading edge of the next similar element, or from trailing edge to trailing edge

3.6
error correction codeword
encodes a value derived from the error correction codeword algorithm to enable decode errors to be detected and, depending on the error correction level, to be corrected

3.7
Extended Channel Interpretation
ECI
procedure within some symbologies, including PDF417, to replace the default interpretation with another interpretation in a reliable manner

Note 1 to entry: The interpretation intended prior to producing the symbol can be retrieved after decoding the scanned symbol to recreate the data message in its original format.

3.8
Extended Channel Model
system for encoding and transmitting both data message bytes and control information about the message, the control information being communicated using Extended Channel Interpretation (ECI) escape sequences

Note 1 to entry: A decoder complying with this model operates in Extended Channel Mode.

3.9
function codeword
initiates a particular operation within a symbology

EXAMPLE To switch between data encoding sets, to invoke a compaction scheme, to program the reader, or to invoke Extended Channel Interpretations.

3.10
Global Label Identifier
GLI
procedure in the PDF417 symbology which behaves in a similar manner to Extended Channel Interpretation

Note 1 to entry: The GLI system was the PDF417-specific precursor to the symbology-independent ECI system.

3.11
Macro PDF417
procedure in the PDF417 symbology logically to distribute data from a computer file across a number of related PDF417 symbols

Note 1 to entry: The procedure considerably extends the data capacity beyond that of a single symbol.

Note 2 to entry: This procedure is similar to the Structured Append feature in other symbologies.

3.12
Mode Latch codeword
used to switch from one mode to another mode, which stays in effect until another latch or shift codeword is implicitly or explicitly brought into use, or until the end of the symbol is reached

3.13
Mode Shift codeword
used to switch from one mode to another for one codeword, after which encoding returns to the original mode

3.14
Row Indicator codeword
PDF417 codeword adjacent to the start or stop character in a row, which encodes information about the structure of the PDF417 symbol in terms of the row identification, total number of rows and columns, and the error correction level

3.15
Symbol Length Descriptor
first codeword in a PDF417 symbol, which encodes the total number of data codewords in the symbol

4 Symbols, operations and abbreviated terms

4.1 Symbols

For the purposes of this International Standard, the following mathematical symbols apply. There are some cases where the symbols below have been used in a different manner in an equation. This has been done for consistency with a more general use of the notation and is always clearly defined in the text.

A symbol aspect ratio (height to width) of a PDF417 symbol

b element width in a symbol character

c number of columns in the symbol in the data region (excluding start, stop and row indicator codewords)

d data codeword including all function codewords

E error correction codeword

e edge to similar edge dimension in a symbol character

F row number

f number of substitution errors

H height of symbol including quiet zone

K cluster number

k number of error correction codewords

L left row indicator

l number of erasures

m number of source data codewords prior to the addition of the Symbol Length Descriptor and any pad codewords

n total number of data codewords including Symbol Length Descriptor and any pad codewords

p pitch or width of a symbol character

Q_H horizontal quiet zone

Q_V vertical quiet zone

R right row indicator

r number of rows in the symbol

s error correction level

W width of symbol including quiet zone

X X-dimension or module width

Y module height (also called row height)

4.2 Mathematical operations

For the purposes of this International Standard, the following mathematical operations apply.

div is the integer division operator, rounding down

INT is the integer value, i.e. where a number is rounded down to its whole number component, ignoring its decimal fractions

mod is the positive integer remainder after division. If the remainder is negative, add the value of the divisor to make it positive. For example, the remainder of –29 160 divided by 929 is –361 which when added to 929 yields 568.

4.3 Abbreviated terms

For the purposes of this International Standard, the following abbreviated terms apply.

ECI Extended Channel Interpretation

GLI Global Label Identifier

5 Requirements

5.1 Symbology characteristics

5.1.1 Basic characteristics

PDF417 is a bar code symbology with the following basic characteristics.

a) Encodable character set:

1) Text Compaction mode (see 5.4.1.5) permits all printable ASCII characters to be encoded, i.e. values 32 to 126 inclusive in accordance with ISO/IEC 646 (IRV), as well as selected control characters;

2) Byte Compaction mode (see 5.4.3) permits all 256 possible 8-bit byte values to be encoded. This includes all ASCII characters value 0 to 127 inclusive and provides for international character set support;

3) Numeric Compaction mode (see 5.4.4) permits efficient encoding of numeric data strings;

4) Up to 811 800 different character sets or data interpretations;

5) Various function codewords for control purposes.

b) Symbol character structure: (*n, k, m*) characters of 17 modules (*n*), 4 bar and 4 space elements (*k*), with the largest element 6 modules wide (*m*).

c) Maximum possible number of data characters per symbol (at error correction level 0): 925 data codewords which can encode:

1) Text Compaction mode: 1 850 characters (at 2 data characters per codeword);

2) Byte Compaction mode: 1 108 characters (at 1,2 data characters per codeword);

3) Numeric Compaction mode: 2 710 characters (at 2,93 data characters per codeword).

At the minimum recommended error correction level, there is a maximum of 863 data codewords which can encode:

4) Text Compaction mode: 1 726 characters (at 2 data characters per codeword);

5) Byte Compaction mode: 1 033 characters (at 1,2 data characters per codeword);

6) Numeric Compaction mode: 2 528 characters (at 2,93 data characters per codeword).

d) Symbol size:

1) Number of rows: 3 to 90;

2) Number of columns: 1 to 30;

3) Width in modules: 90X to 583X including quiet zones;

4) Maximum codeword capacity: 928 codewords;

5) Maximum data codeword capacity: 925 codewords.

Since the number of rows and the number of columns are selectable, the aspect ratio of a PDF417 symbol may be varied when printing to suit the spatial requirements of the application.

e) Selectable error correction: 2 to 512 codewords per symbol (see 5.7).

f) Non-data overhead:

1) Per row: 73 modules, including quiet zones;

2) Per symbol: a minimum of 3 codewords, represented as symbol characters.

g) Code type: continuous, multi-row two-dimensional.

h) Character self-checking: Yes.

i) Bi-directionally decodable: Yes.

5.1.2 Summary of additional features

Additional features which are inherent or optional in PDF417 are summarised below.

a) **Data compaction**: (inherent) Three schemes are defined to compact a number of data characters into codewords. Generally data is not directly represented on a one character for one codeword basis (see 5.4.1.5 to 5.4.4).

b) **Extended Channel Interpretations**: (optional) These mechanisms allow up to 811 800 different data character sets or interpretations to be encoded (see 5.5).

c) **Macro PDF417**: (optional) This mechanism allows files of data to be represented logically and consecutively in a number of PDF417 symbols. Up to 99 999 different PDF417 symbols can be so linked or concatenated and be scanned in any sequence to enable the original data file to be correctly reconstructed (see 5.13).

d) **Edge to edge decodable**: (inherent) PDF417 can be decoded by measuring elements from edge to similar edge (see 5.3.1).

e) **Cross row scanning**: (inherent) The combination of the following three characteristics in PDF417 facilitates cross row scanning:

   1) being synchronised horizontally, or self clocking;

   2) row identification;

   3) being synchronised vertically, by using the cluster values to achieve local row discrimination.

   This combination allows a single linear scan to cross a number of rows and achieve a partial decode of the data so long as at least one complete symbol character per row is decoded into its codeword. The decoding algorithm can then place the individual codewords into a meaningful matrix.

f) **Error correction**: (inherent) A user may define one of 9 error correction levels. All but Level 0 not only detect errors but also can correct erroneously decoded or missing codewords (see 5.7).

g) **Compact PDF417**: (optional) In relatively 'clean' environments, it is possible to reduce some of the row overhead to improve the symbol density (see 5.12).

NOTE In earlier specifications of PDF417, Compact PDF417 was called Truncated PDF417. Compact PDF417 is the preferred term to avoid confusion with the more general use of the term 'truncated'.

5.2 Symbol structure

5.2.1 PDF417 symbol parameters

Each PDF417 symbol consists of a stack of vertically aligned rows with a minimum of 3 rows (maximum 90 rows). Each row shall include a minimum of 1 symbol character (maximum 30 symbol characters), excluding start, stop and row indicator columns. The symbol shall include a quiet zone on all four sides. Figure 1 illustrates a PDF417 symbol encoding the text: PDF417 Symbology Standard.

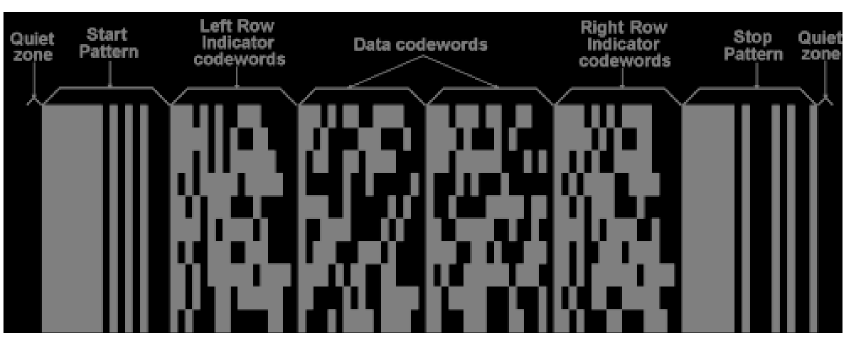


Figure 1 — PDF417 symbol structure

5.2.2 Row parameters

Each PDF417 row shall comprise of the following:

a) leading quiet zone;

b) start character;

c) left row indicator symbol character;

d) 1 to 30 symbol characters;

e) right row indicator symbol character;

f) stop character;

g) trailing quiet zone.

NOTE The number of symbol characters (or codewords) defined in item ‘d’ above is equal to the number of data columns in the PDF417 symbol.

5.2.3 Codeword sequence

A PDF417 symbol may contain up to 928 symbol characters or codewords. Symbol character is the more appropriate term to refer to the printed bar/space pattern; codeword is more appropriate for the numeric value of the symbol character. The codewords shall follow this sequence:

a) The first codeword, the Symbol Length Descriptor, shall always encode the total number of data codewords in the symbol, including the Symbol Length Descriptor itself, data codewords and pad codewords, but excluding the number of error correction codewords.

b) The data codewords shall follow, from the most significant encodable character. Function codewords may be inserted to achieve data compaction.

c) Pad codewords to enable the codeword sequence to be represented in a rectangular matrix. Pad codewords may also be used to fill additional complete rows to achieve an aspect ratio desired or as specified by the application.

d) An optional Macro PDF417 Control Block.

e) Error correction codewords for error detection and correction.

The codewords are arranged with the most significant codeword adjacent to the Symbol Length Descriptor, and are encoded from left to right and from top row to bottom. Figure 2 illustrates in layout format the sequence for a symbol like what is being shown in Figure 1. In Figure 2, an error correction level of 1 has been used and one pad character was needed to completely fill the symbol matrix.

	L_1	d_{15}	d_{14}	R_1	
	L_2	d_{13}	d_{12}	R_2	
	L_3	d_{11}	d_{10}	R_3	
S	L_4	d_9	d_8	R_4	**S**
T	L_5	d_7	d_6	R_5	**T**
A	L_6	d_5	d_4	R_6	**O**
R	L_7	d_3	d_2	R_7	**P**
T	L_8	d_1	d_0	R_8	
	L_9	E_3	E_2	R_9	
	L_{10}	E_1	E_0	R_{10}	

Figure 2 — PDF417 Example of Symbol Layout Schematic

where

L, R, d and E	are as defined in Clause 4;
d_{15}	Symbol Length Descriptor (in this example, with a value of 16);
d_{14} to d_1	encoded representation of data;
d_0	pad codeword.

The rules and advice for structuring the matrix are included in 5.9.

5.3 Basic encodation

5.3.1 Symbol character structure

Each PDF417 symbol character shall consist of four bar elements and four space elements, each of which can be one to six modules wide. The four bar and four space elements shall measure 17 modules in total. PDF417 symbol characters can be decoded by measuring the e-distances within the character.

Each symbol character is defined by an 8-digit bar-space sequence which represents the module widths of the eight elements of that symbol character. Figure 3 illustrates a symbol character with the bar-space sequence 51111125.

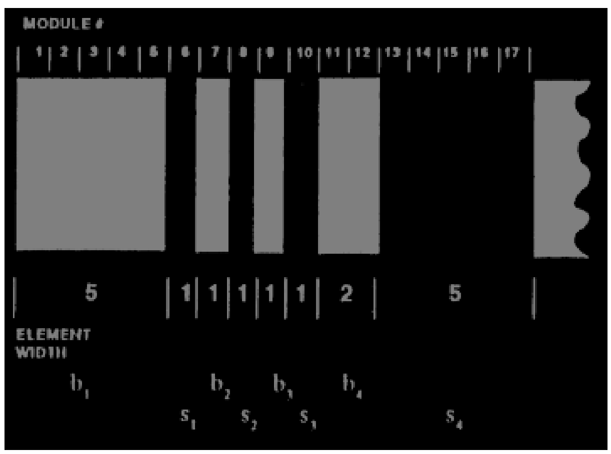


Figure 3 — A PDF417 symbol character

There are 929 defined symbol character values (codewords) numbered from 0 to 928.

The codewords are represented by three mutually exclusive symbol character sets, or clusters. Each cluster encodes the 929 available PDF417 codewords into different bar-space patterns so that one cluster is distinct from another. The cluster numbers are 0, 3, and 6. The cluster definition applies to all PDF417 symbol characters, except for start and stop characters.

The cluster number K is defined by the following formula:

$$K = (b_1 - b_2 + b_3 - b_4 +) \bmod 99$$

where b_1, b_2, b_3 and b_4 represent the width in modules of the four bar elements respectively.

The cluster number K for the symbol character in Figure 3 is:

$K = (5 - 1 + 1 - 2 + 9) \bmod 9 = 3$

The codewords and the bar-space sequences for each cluster of symbol characters are given in Annex A.

5.3.2 Start and stop characters

The start and stop characters shall be composed as defined in Table 1 and illustrated in Figure 4:

Table 1 — Bar-space sequence for Start and Stop Characters

Character	Bar-space sequence								
	B	S	B	S	B	S	B	S	B
Start	8	1	1	1	1	1	1	3	
Stop	7	1	1	3	1	1	1	2	1

NOTE 1 The PDF417 stop and start characters are unique in having elements more than 6 modules wide.

NOTE 2 The stop character has one extra single module bar element.

The start and stop characters shall have the same bar-space sequence for all rows.

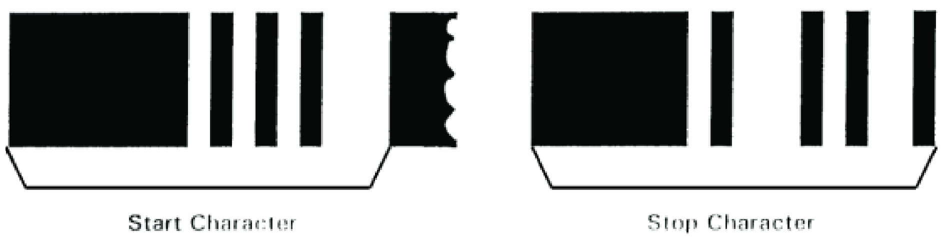


Figure 4 — PDF417 Start and Stop Characters

5.4 High level (data) encodation

High level encoding converts the data characters into their corresponding codewords.

Data compaction schemes shall be used to achieve efficient high level encoding. Three modes are defined below, each of which defines a particular efficient mapping between user defined data and codeword sequences. PDF417 has three data compaction modes:

— Text Compaction mode (see 5.4.1.5);

— Byte Compaction mode (see 5.4.3);

— Numeric Compaction mode (see 5.4.4).

A given string of data bytes may be represented by different codeword sequences, depending on how the encoder switches between compaction modes and sub-modes. There is no single specified way to encode data in a PDF417 symbol.

900 codewords (0 to 899) are available in each mode for data encodation and other functions within the mode. The remaining 29 codewords are assigned to specific functions (see 5.4.1) independent of the current compaction mode.

PDF417 also supports the Extended Channel Interpretation system, which allows different interpretations of data to be accurately encoded in the symbol (see 5.5).

5.4.1 Function codewords

Codewords 900 to 928 are assigned as function codewords as follows:

— for switching between modes (see 5.4.1.1);

— for enhanced applications using Extended Channel Interpretations (ECIs) (see 5.4.1.2);

— for other enhanced applications (see 5.4.1.3 and 5.4.1.4).

At present codewords 903 to 912, 914 to 917, and 919 are reserved. Table 2 defines the complete list of assigned and reserved function codewords. Their functions are defined in 5.4.1.1 to 5.4.1.5. See 5.4.6 for the treatment of reserved codewords.

Table 2 — Assignments of PDF417 function codewords

Codeword	Function	Refer to subclause
900	mode latch to Text Compaction mode	5.4.1.1
901	mode latch to Byte Compaction mode	5.4.1.1, 5.4.3.1
902	mode latch to Numeric Compaction mode	5.4.1.1
903 to 912	Reserved	
913	mode shift to Byte Compaction mode	5.4.1.1
914 to 917, 919	Reserved	
918	linkage flag to associated linear component, in a composite symbol (other than an EAN.UCC Composite symbol)	5.4.1.5
920	linkage flag to associated linear component, in an EAN.UCC Composite symbol	5.4.1.5
921	reader initialisation	5.4.1.4
922	terminator codeword for Macro PDF control block	5.13
923	sequence tag to identify the beginning of optional fields in the Macro PDF control block	5.13
924	mode latch to Byte Compaction mode (used differently from 901)	5.4.1.1, 5.4.3.1
925 to 927	identifier for an Extended Channel Interpretation (ECI)	5.5
928	Macro marker codeword to indicate the beginning of a Macro PDF Control Block	5.13

5.4.1.1 Function codewords for mode switching

In one PDF417 symbol it is possible to switch back and forth between modes as often as required. Advice about selecting the appropriate modes is given in 5.4.5.

A Mode Latch codeword may be used to switch from the current mode to the indicated destination mode which stays in effect until another mode switch is explicitly brought into use. Codewords 900 to 902 and 924 are assigned for this purpose. Table 3 defines their function.

The Mode Shift codeword 913 shall cause a temporary switch from Text Compaction mode to Byte Compaction mode. This switch shall be in effect for only the next codeword, after which the mode shall revert to the prevailing sub-mode of the Text Compaction mode. Codeword 913 is only available in Text Compaction mode; its use is described in 5.4.2.4.

Table 3 — Mode Definition and Mode Switching Codewords

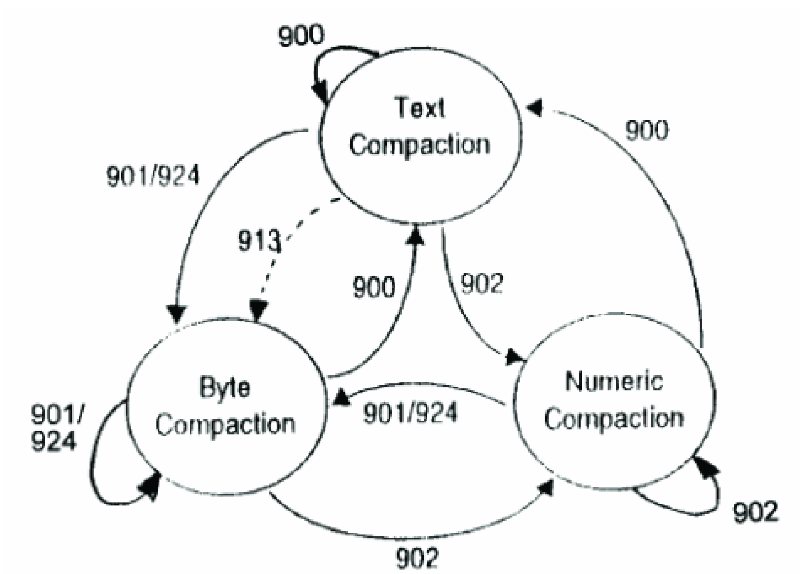
Destination Mode	Mode Latch	Mode Shift
Text Compaction	900	
Byte Compaction	901/924	913
Numeric Compaction	902	

NOTE The table identifies the codeword to be used to switch to the defined mode.

The switching rules between the three modes are defined in Table 4 and shown schematically in Figure 5.

Table 4 — Mode Transition Table, Showing Codewords and Their Function

Original Mode	Destination Mode		
	Text	**Byte**	**Numeric**
Text	900 mode latch	913 mode shift 901 mode latch 924 mode latch	902 mode latch
Byte	900 mode latch	901 mode latch 924 mode latch	902 mode latch
Numeric	900 mode latch	901 mode latch 924 mode latch	902 mode latch



Key

— — — mode shift

——— mode latch

Figure 5 — Available Mode Switching

The switching rules into Byte Compaction mode are more fully defined in 5.4.3.1.

5.4.1.2 Function codewords for switching to Extended Channel Interpretations

An ECI codeword can be used to switch to a particular interpretation, which stays in effect until another ECI codeword is explicitly brought into use or until the end of the data. Codewords 925 to 927 are assigned to this function (see 5.5).

5.4.1.3 Function codewords for Macro PDF417

Macro PDF417 symbols (see 5.13) shall use codeword 928 at the start of the Macro PDF417 Control Block. Codewords 922 and 923 are used for special functions in Macro PDF417.

5.4.1.4 Function codeword for reader initialisation

Codeword 921 shall be used to instruct the reader to interpret the data contained within the symbol as programming for reader initialisation. Codeword 921 shall appear as the first codeword after the Symbol Length Descriptor. In the case of a Macro PDF417 initialisation sequence, codeword 921 shall appear in every symbol.

The data contained in an initialisation symbol or sequence of symbols shall not be transmitted by the reader.

5.4.1.5 Function codewords for linkage flags in composite symbols

Codeword 920 shall be used as a linkage flag to signal the presence of an associated EAN.UCC linear component in accordance with ISO/IEC 24723.

Codeword 918 shall be used as a linkage flag to signal the presence of an associated linear component in any other composite symbology.

When used, the 918 or 920 codeword may appear in any position in the symbol. The applicable composite symbology specification may define a specific position of the linkage flag.

Readers supporting the indicated composite application should decode and transmit the data from all components as specified in the relevant composite symbology specification. Readers not supporting the indicated composite application may treat the 918 or 920 codeword as a reserved codeword (see 5.4.6). In addition, readers not supporting the indicated 918 composite application may have an option to ignore the two-dimensional composite component and transmit only the data from the associated linear component.

5.4.2 Text Compaction mode

The Text Compaction mode includes all the printable ASCII characters (i.e. values from 32 to 126) and three ASCII control characters: HT or tab (ASCII value 9), LF or line feed (ASCII value 10), and CR or carriage return (ASCII value 13). The Text Compaction mode also includes various latch and shift characters which are used exclusively within the mode.

The Text Compaction mode encodes up to 2 characters per codeword. The compaction rules for converting data into PDF417 codewords are defined in 5.4.2.2. The sub-mode switches are defined in 5.4.2.3.

5.4.2.1 Text Compaction sub-modes

The Text Compaction mode has four sub-modes:

— Alpha (uppercase alphabetic);

— Lower (lowercase alphabetic);

— Mixed (numeric and some punctuation);

— Punctuation.

Each sub-mode contains 30 characters, including sub-mode latch and shift characters.

The default compaction mode for PDF417 in effect at the start of each symbol shall always be Text Compaction mode Alpha sub-mode (uppercase alphabetic). A latch codeword from another mode to the Text Compaction mode shall always switch to the Text Compaction Alpha sub-mode.

All the characters and their values are defined in Table 5.

Table 5 — Text Compaction Sub-Mode Definition

	Text Compaction Sub-Modes							
Base 30	**Alpha**		**Lower**		**Mixed**		**Punctuation**	
Value	**Char**	**ASCII**	**Char**	**ASCII**	**Char**	**ASCII**	**Char**	**ASCII**
0	A	65	a	97	0	48	;	59
1	B	66	b	98	1	49	<	60
2	C	67	c	99	2	50	>	62
3	D	68	d	100	3	51	@	64
4	E	69	e	101	4	52	[	91
5	F	70	f	102	5	53	\	92
6	G	71	g	103	6	54	]	93
7	H	72	h	104	7	55	_	95
8	I	73	i	105	8	56	‘	96
9	J	74	j	106	9	57	~	126
10	K	75	k	107	&	38	!	33
11	L	76	l	108	CR	13	CR	13
12	M	77	m	109	HT	9	HT	9
13	N	78	n	110	,	44	,	44
14	O	79	o	111	:	58	:	58
15	P	80	p	112	#	35	LF	10
16	Q	81	q	113	-	45	-	45
17	R	82	r	114	.	46	.	46
18	S	83	s	115	$	36	$	36
19	T	84	t	116	/	47	/	47
20	U	85	u	117	+	43	“	34
21	V	86	v	118	%	37	|	124
22	W	87	w	119	*	42	*	42
23	X	88	x	120	=	61	(	40
24	Y	89	y	121	^	94	)	41
25	Z	90	z	122	pl		?	63
26	space	32	space	32	space	32	{	123

al = latch to alpha
as = shift to alpha
ll = latch to lower
ml = latch to mixed
pl = latch to punctuation
ps = shift to punctuation

Table 5 *(continued)*

	Text Compaction Sub-Modes							
Base 30	**Alpha**		**Lower**		**Mixed**		**Punctuation**	
Value	**Char**	**ASCII**	**Char**	**ASCII**	**Char**	**ASCII**	**Char**	**ASCII**
27	ll		as		ll		}	125
28	ml		ml		al		'	39
29	ps		ps		ps		al	
al = latch to alpha as = shift to alpha ll = latch to lower ml = latch to mixed pl = latch to punctuation ps = shift to punctuation								

NOTE The Char columns above show the default interpretation of ECI 000003 of the byte values shown in the adjacent ASCII columns. Each table entry represents half a codeword, i.e. the value range from 0 to 29 (see 5.4.2.2)

5.4.2.2 Compaction rules for encoding in Text Compaction mode

In Text Compaction mode, pairs of data characters are represented in a single codeword. The values assigned to the data characters are in the range 0 to 29 (i.e. base 30) and are defined in Table 5. For each pair of base 30 values, the first or left value shall be designated the more significant value h, the other shall be designated the less significant value l.

The encoded PDF417 codeword is defined using the following formula:

$$d = h \times 30 + l$$

where d is as defined in Clause 4.

The formula shall also apply to the base 30 values for shifts and latches within the Text Compaction mode. Appropriate latch and shift values shall be used between sub-modes. If the encoding of the character sequence does not result in an even number of base 30 values, see 5.4.2.4 for the specific mechanism to use.

The following example illustrates how compaction is achieved in Text Compaction mode.

EXAMPLE Data to be encoded: PDF417

Table 6 — Example of Text Compaction Encoding

Character Pairs	h	l	$h \times 30 + l$	Codeword
P D	15	3	15 × 30 + 3	453
F ml	5	28	5 × 30 + 28	178
4 1	4	1	4 × 30 + 1	121
7 ps	7	29	7 × 30 + 29	239

NOTE 1 ml (latch to mixed sub-mode) is used to switch to encode the numeric characters.

NOTE 2 ps is used as a pad value in this example, other shift and latch values can be used (see 5.4.2.4)

The data PDF417 is represented by codewords 453, 178, 121, 239

5.4.2.3 Text Compaction sub-mode switching: latch and shift function

Switching from one sub-mode to another within Text Compaction mode shall be through the latch and shift values defined for the sub-mode in effect prior to the switch.

A sub-mode shift shall be used to switch from one Text Compaction sub-mode to another for only one data character. Subsequent codewords revert to the sub-mode being used immediately prior to the shift (except when ps is used as a pad, see 5.4.2.4). The shift functions are as follows:

— ps = shift to punctuation sub-mode;

— as = shift to uppercase alphabetic sub-mode.

A sub-mode latch shall be used to switch from one Text Compaction sub-mode to another, which stays in effect until another latch or shift is explicitly brought into use. The latch functions are as follows:

— al = latch to uppercase alphabetic sub-mode;

— ll = latch to lowercase alphabetic sub-mode;

— ml = latch to mixed (numeric and other punctuation) sub-mode;

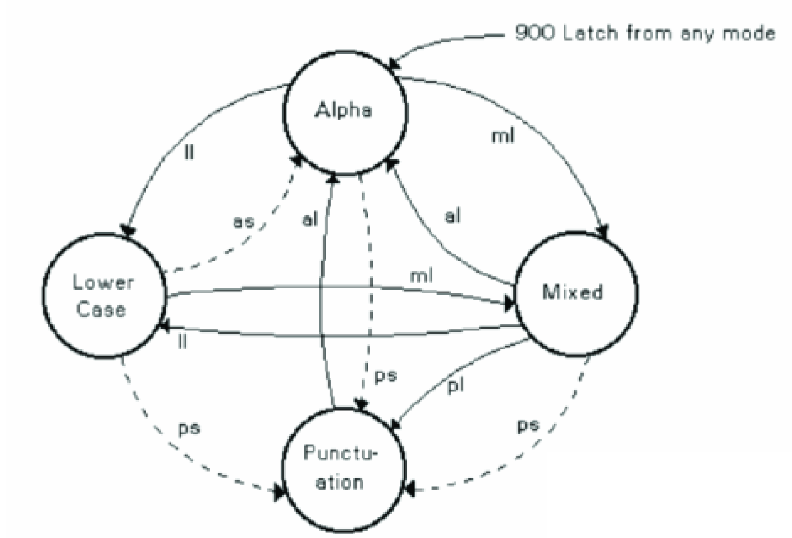
— pl = latch to punctuation sub-mode.

A limited set of latch and shift functions is available within each Text Compaction sub-mode. Those which are available are listed in Table 5. Table 7 shows the transition table between Text Compaction sub-modes; Figure 6 shows this schematically.

NOTE A sub-mode latch may be followed by another sub-mode latch or sub-mode shift; but a sub-mode shift may not be followed by either a sub-mode shift or sub-mode latch.

Table 7 — Text Compaction sub-mode transition table

Original Sub-Mode	Destination Sub-Mode			
	Alpha	Lower	Mixed	Punctuation
Alpha		ll	ml	ps
Lower	as		ml	ps
Mixed	al	ll		ps pl
Punctuation	al			



Key

————————	sub-mode latch
- - - - - - - - - -	sub-mode shift
ll	latch to lower case sub-mode
ps	shift to punctuation sub-mode
ml	latch to mixed sub-mode
as	shift to alpha sub-mode
al	latch to alpha sub-mode
pl	latch to punctuation sub-mode

Figure 6 — Text Compaction Sub-Mode Switching

5.4.2.4 Mechanisms for using a pad in Text Compaction mode

If the Text Compaction character sequence does not result in an even number of base 30 values, a pad shall be added to the end of the character sequence. An example is illustrated in Table 6. As there are no specific null functions in Text Compaction mode, the sub-mode shift and latch shall be used in accordance with the mechanisms defined for the following cases.

The cases are as follows:

a) If the character sequence continues to the end of the data, or the Text Compaction mode character sequence is followed by latching to another compaction mode, then the pad can be any of the sub-mode shifts or sub-mode latches.

b) If the Text Compaction mode character sequence is followed by a byte shift (codeword 913) to encode a single Byte Compaction mode character, two mechanisms can be used depending on the Text Compaction sub-mode being used prior to the Byte Compaction shift:

   1) If the Text Compaction sub-mode is other than punctuation, then base 30 value 29 (ps) should be used if encodation is intended to revert to the same Text Compaction sub-mode. The decoder shall ignore a ps immediately preceding codeword 913.

   2) If the Text Compaction sub-mode is punctuation, then base 30 value 29 (al) shall be used. The decoder shall not ignore the (al), and therefore will return to the Alpha sub-mode.

5.4.2.5 Switching from Text Compaction mode

Text Compaction mode may be terminated by the end of the symbol, or by any of the following codewords:

— 900 (Text Compaction mode latch);

— 901 (Byte Compaction mode latch);

— 902 (Numeric Compaction mode latch);

— 924 (Byte Compaction mode latch);

— 928 (Beginning of Macro PDF417 Control Block);

— 923 (Beginning of Macro PDF417 Optional Field);

— 922 (Macro PDF417 Terminator).

The last three codewords only occur within the Macro PDF417 Control Block of a Macro PDF417 symbol (see 5.13.1). Text Compaction mode is also affected by the presence of a reserved codeword (see 5.4.6).

If the decoder is in the Text Compaction mode and encounters codeword 913 (Byte Compaction mode shift), it decodes the codeword following codeword 913 as a single binary byte and then returns to the Text Compaction mode. The sub-mode to which the decoder returns is the most-recently-latched sub-mode that was in effect prior to codeword 913; a ps sub-mode shift immediately prior to codeword 913 is ignored.

If the decoder is in the Text Compaction mode and encounters codeword 900 (Text Compaction mode latch), the decoder reinitialises to the Alpha sub-mode.

5.4.3 Byte Compaction mode

The Byte Compaction mode enables a sequence of 8-bit bytes to be encoded into a sequence of codewords. It is accomplished by a Base 256 to Base 900 conversion, which achieves a compaction ratio of six bytes to five codewords (1,2 : 1).

All the characters and their values (0 to 255) are defined in Annex B. This shall be treated as the default graphical and control character interpretation. When ECIs are invoked (see 5.5), this interpretation is defined as ECI 000003 (see 5.5.2).

NOTE In previous PDF417 specifications, the default character set corresponded to ECI 000002 (a code page of the MS-DOS operating system). The interpretation of byte character values below 128 is unchanged and the operation of PDF417 printing and scanning equipment is unaffected. New applications that use byte character values above 127 should assume the ECI 000003 default interpretation for broadest compatibility with current systems. Existing applications utilizing values above 127 may continue to encode and process data as before. Applications that rely upon the prior default interpretation of values above 127 may encode ECI 000002 explicitly if they wish to signal this interpretation.

5.4.3.1 Switching to Byte Compaction mode

When in either Text or Numeric Compaction mode, to switch to Byte Compaction mode, it is necessary to use one of the following codewords:

— **mode latch 924** shall be used when the total number of Byte Compaction characters to be encoded is an integer multiple of 6;

— **mode latch 901** shall be used when the total number of Byte Compaction characters to be encoded is not a multiple of 6;

— **mode shift 913** can be used instead of codeword 901 when a single Byte Compaction character has to be encoded.

5.4.3.2 Compaction rules for encoding a single Byte Compaction character (using mode shift 913)

To encode a single Byte Compaction character, the codeword shall be the decimal value (0 to 255) of the character as defined in Annex B.

5.4.3.3 Compaction rules for encoding longer Byte Compaction character strings (using mode latch 924 or 901)

The following procedure shall be used to encode Byte Compaction character data.

a) Establish the total number of Byte Compaction characters.

b) If a perfect multiple of 6, mode latch 924 shall be used; else mode latch 901 shall be used.

c) Sub-divide the number of Byte Compaction characters into a sequence of 6 characters, from left to right (the most to least significant characters). If less than 6 characters, go to Step 7.

d) Assign the decimal values of the 6 data bytes to be encoded in Byte Compaction mode as b_5 to b_0 (where b_5 is the first data byte).

e) Carry out a base 256 to base 900 conversion to produce a sequence of 5 codewords. Annex C defines an algorithm and illustrates a worked example.

f) Repeat from Step 3 as necessary.

g) For the remaining Byte Compaction characters when mode latch 901 is used, (i.e. when the last group is less than 6 Byte Compaction characters) the codeword(s) shall be the decimal value(s) (0 to 255) of the character(s) as defined in Annex B, the most to the least significant.

NOTE Byte Compaction mode following mode latch 901 assumes that the total number of bytes to be encoded is not a multiple of six. If the number of bytes to be encoded in Byte Compaction mode happens to be an integer multiple of six, then either a 901 or a 924 Byte Compaction Latch shall be encoded, placed at any point in the symbol that would create a correct encodation according to these encodation rules. For example, a 924 codeword as either the first or second codeword would identify the following stream of Byte Compaction mode codewords as encoding a multiple-of-six number of bytes. Alternatively, a 901 could be placed at any position within the Byte Compaction mode codeword stream that would split that stream into two segments, neither of which encodes a multiple-of-six number of bytes.

If additional encodation is required in Text Compaction or Numeric Compaction modes, the appropriate latch characters shall be used (see 5.4.1.1).

5.4.3.4 Switching from Byte Compaction

Byte Compaction mode may be terminated by the end of the symbol, or by any of the following codewords:

— 900 (Text Compaction mode latch);

— 901 (Byte Compaction mode latch);

— 902 (Numeric Compaction mode latch);

— 924 (Byte Compaction mode latch);

— 928 (Beginning of Macro PDF417 Control Block);

— 923 (Beginning of Macro PDF417 Optional Field);

— 922 (Macro PDF417 Terminator).

The last three codewords only occur within the Macro PDF417 Control Block of a Macro PDF417 symbol (see 5.13.1). Byte Compaction mode is also affected by the presence of a reserved codeword (see 5.4.6).

Re-invoking Byte Compaction mode (by using codeword 901 or 924 while in Byte Compaction mode) serves to terminate the previous Byte Compaction mode grouping of 6 Byte Compaction characters as described in 5.4.3.3, and then to start a new grouping. This procedure may be necessary when an ECI assignment number needs to be encoded (see 5.5.3.2).

During the decode process for Byte Compaction mode, the treatment of the final group of codewords differs depending on whether Byte Compaction mode is invoked with codeword 901 or 924.

If Byte Compaction mode is invoked with codeword 924, the total number of codewords within the compaction mode shall be a multiple of five. If this is not the case, the symbol is invalid. All the 5-codeword groups are decoded into 6-byte groups.

If Byte Compaction mode is invoked with codeword 901, the final group of codewords is interpreted directly as one byte per codeword, without compaction. Therefore, if the last group consists of five codewords, the group is interpreted as 5 bytes, rather than 6.

5.4.4 Numeric Compaction mode

The Numeric Compaction mode is a method for base 10 to base 900 data compaction and should be used to encode long strings of consecutive numeric digits. The Numeric Compaction mode encodes up to 2,93 numeric digits per codeword.

5.4.4.1 Latch to Numeric Compaction mode

Numeric Compaction mode may be invoked when in Text Compaction or Byte Compaction modes using mode latch 902.

5.4.4.2 Compaction rules for encoding long strings of consecutive numeric digits

The following procedure shall be used to compact numeric data.

a) Divide the string of digits into groups of 44 digits, except for the last group, which may contain fewer.

b) For each group, add the digit 1 to the most significant position to prevent the loss of leading zeros.

EXAMPLE

original data	00246812345678
after step 2	1 00246812345678

NOTE The leading digit 1 is removed in the decode algorithm.

c) Perform a base 10 to base 900 conversion. Annex D defines an algorithm for this and illustrates a worked example.

d) Repeat from Step 2 as necessary.

The following rules can be used to determine the precise number of codewords in Numeric Compaction mode:

— groups of 44 numeric digits compact to 15 codewords;

— for groups of shorter sequences of digits, the number of codewords can be calculated as follows:

Codewords = INT (number of digits/3) +1

EXAMPLE For a 28 digit sequence

INT (28/3) + 1 = 9 + 1 = 10 codewords

5.4.4.3 Switching from Numeric Compaction mode

Numeric Compaction mode may be terminated by the end of the symbol, or by any of the following codewords:

— 900 (Text Compaction mode latch);

— 901 (Byte Compaction mode latch);

— 902 (Numeric Compaction mode latch);

— 924 (Byte Compaction mode latch);

— 928 (Beginning of Macro PDF417 Control Block);

— 923 (Beginning of Macro PDF417 Optional Field);

— 922 (Macro PDF417 Terminator).

The last three codewords only occur within the Macro PDF417 Control Block of a Macro PDF417 symbol (see 5.13.1). Numeric Compaction mode is also affected by the presence of a reserved codeword (see 5.4.6).

Re-invoking Numeric Compaction mode (by using codeword 902 while in Numeric Compaction mode) serves to terminate the current Numeric Compaction mode grouping as described in 5.4.4.2, and then to start a new grouping. This procedure may be necessary when an ECI assignment number needs to be encoded (see 5.5.3.4).

During the decode process for Numeric Compaction mode, the result of the base 900 to base 10 conversion shall result in a number whose most significant digit is a ‘1’. If the base 900 to base 10 conversion does not result in a number beginning with ‘1’, the symbol shall be treated as invalid. The leading ‘1’ is removed to produce the original number.

5.4.5 Advice to select the appropriate compaction mode

All basic implementations for printing and scanning PDF417 symbols shall support the three modes: Text Compaction, Byte Compaction and Numeric Compaction. The default character set for Text Compaction shall be as defined in Table 5; and that for Byte Compaction shall be as defined in Annex B. Text Compaction mode is usually more efficient than Byte Compaction mode for encoding standard ASCII text files because of its better compaction of ASCII character values 9, 10, 13 and 32 to 126.

The Numeric Compaction mode should be used for long numeric strings.

Advice about switching between modes to minimise the number of codewords is provided as an algorithm in Annex N.

5.4.6 Treatment of PDF417 reserved codewords

5.4.6.1 Overview

PDF417 symbols intended for use in open systems should not employ any of the codewords that are listed as reserved (see 5.4.1) in the current edition of this International Standard. However, decoding equipment should support the transmission of reserved codewords using escape sequences as defined in 5.17.4. Decoding equipment may also support an option of treating such symbols as invalid, as would be the case when operating in Basic Channel Mode.

Receiving systems should discard data containing any escape sequences using reserved codewords, unless the system is aware of a new definition for a previously reserved codeword.

5.4.6.2 Making future use of reserved codewords

Any new function codewords, to be defined in future revisions of this International Standard, shall have their encoding rules specified to provide backwards compatibility with pre-existing equipment. Specifically

a) when a new signalling codeword (as opposed to a new compaction mode codeword) is encoded, it shall immediately be followed by an appropriate compaction mode latch so that the subsequent data codewords are interpreted and transmitted as a byte stream, rather than as a series of escaped uninterpreted codewords. This approach will achieve the desired results with decoding equipment conforming with both the original and this PDF417 standard, regardless of whether that equipment employs the original or the new transmission protocol, and

b) at the receiving system, the ECI decoder will process the signal ECIs (i.e. Macro Control Blocks and escaped uninterpreted codewords) before the encodable ECIs (such as character sets). Thus, the encoder should take into account the order of operations as follows:

   1) the Macro Control Block ECIs, if present, will be used to assemble the complete byte stream in the proper order;

   2) the escaped data codewords will be translated by the ECI decoder according to the rules of the new compaction mode or signalling ECI, and the resulting data bytes will be inserted into their proper place within the byte stream;

   3) finally, the character set and other encodable ECIs will be applied to the resulting byte stream.

5.5 Extended Channel Interpretation

The Extended Channel Interpretation (ECI) protocol allows the output data stream to have interpretations different from that of the default character set. The ECI protocol is defined consistently across a number of symbologies, including PDF417. ECIs are assigned by AIM Global, Inc.

NOTE Originally, a symbology specific scheme called Global Label Identifiers (GLIs) was defined for PDF417. Encoding and decoding ECIs is identical to earlier specifications for PDF417 GLIs. However, the transmission protocol for decoded messages according to earlier PDF417 specifications for GLIs is different from the transmission protocol for ECIs. There are also differences with respect to the use of interpretive ECIs with Macro PDF417. This International Standard permits the use of the earlier and current protocols in such a way that old and new equipment can continue to co-exist.

Five broad types of interpretations are supported in PDF417:

a) character sets (or code pages);

b) general purpose interpretations such as data encryption and data compression (as distinct from the compaction modes of the symbology);

c) user defined interpretations for closed systems;

d) transmission of control information for Macro PDF417;

e) transmission of uninterpreted PDF417 codewords.

Transmission of the Extended Channel Interpretation protocol is fully specified in the AIM International standard ITS/04-001, Part 1. The protocol provides a consistent method to specify particular interpretations of byte values before printing and after decoding.

The Extended Channel Interpretation (ECI) is identified by a 6-digit number which is encoded in the PDF417 symbol by one of three specific codewords followed by one or two codewords (see 5.5.1). A specific ECI may be invoked anywhere in the encoded message subject to the rules of the compaction modes (see 5.5.3).

The ECI protocol can only be used with decoders enabled to transmit the symbology identifier (see 5.17.5). Decoders that are not enabled to transmit the symbology identifier cannot reliably convey the escape sequences from any symbol containing an ECI.

5.5.1 Encoding the ECI assignment number

An ECI can be invoked anywhere in the data stream, subject to the conditions defined in 5.5.3. Once an ECI has been invoked, switching may take place between any of the compaction modes. The compaction mode used is determined strictly by the 8-bit data values being encoded and does not depend on the ECI in force. For example, a sequence of values in the range 48 to 57 (decimal) would be most efficiently encoded in Numeric Compaction mode even if the sequence were not to be interpreted as numbers.

The ECI assignment number is encoded in one of the three ECI codeword sequences, which begin with the codewords 927, 926 or 925. One or two additional codewords are used to encode the ECI assignment number. The encodation rules are defined in Table 8.

Table 8 — Encoding ECI assignment numbers

ECI assignment number	Codeword sequence	Codewords	Ranges
000000 to 000899	C_0	927	
	C_1	ECI_no	C_1 = (0 to 899)
000900 to 810899	C_0	926	
	C_1	ECI_no div 900 - 1	C_1 = (0 to 899)
	C_2	ECI_no mod 900	C_2 = (0 to 899)
810900 to 811799	C_0	925	
	C_1	ECI_no - 810 900	C_1 = (0 to 899)

There are 811 800 possible ECI assignment numbers available in PDF417.

NOTE The encodation method is identical to the GLI scheme incorporated in the original AIM USA (1994) and AIM Europe (1994) PDF417 specifications.

The following example illustrates the encodation:

EXAMPLE ECI = 013579

Codewords: [926] [(13 579 div 900) - 1] [13 579 mod 900]

= [926][15 - 1] [79]

= [926] [14] [79]

5.5.2 Pre-assigned and default Extended Channel Interpretations

The following ECIs, ECI 000000 to ECI 000003, have been pre-assigned to be backwards compatible with existing symbology specifications, including PDF417.

— ECI 000000 (equates to original GLI 0) represents the default encodation scheme of encoders compliant with the original PDF417 standards.

— ECI 000001 (equates to original GLI 1) represents the GLI encodation scheme of a number of symbologies with characters 0 to 127 being identical to those of ISO/IEC 646:1991, International Reference Version (equivalent to ANSI X3.4) and characters 128 to 255 being identical to those values of ISO/IEC 8859-1.

NOTE ECI 000000 (equivalent to GLI 0) and ECI 000001 (equivalent to GLI 1) require a return-to-GLI 0 logic at the beginning of each encoded symbol of a Macro PDF417 set of symbols. This protocol is not adopted for other Extended Channel Interpretations.

— ECI 000002 has an equivalent code table to ECI 000000, without the return-to-GLI 0 logic.

— ECI 000003 has an equivalent code table to ECI 000001, without the return-to-GLI 0 logic. ECI 000003 is the default encodation scheme for encoders fully compliant with this edition of this standard.

ECI 000000 and ECI 000001 shall not be encoded in the same PDF417 symbol or Macro PDF417 symbol set as other ECIs, except for user defined ECIs. ECI 000002 and ECI 000003 provide the compatible alternatives to ECI 000000 and ECI 000001 respectively. ECI 000000 and ECI 000001 should not be used in new applications.

5.5.3 Encoding ECI sequences within compaction modes

The general encodation principle is that ECIs are applied to the source data byte stream (to signal various interpretations) producing a modified byte stream that is encoded into PDF417 symbols using the symbology's compaction modes for efficiency. The ECI encoding, and symbology specific compaction, form two independent logical layers of the process.

Although ECI assignments and compaction modes may generally be intermixed, some combinations can produce illogical or ambiguous behaviour. The following clauses define how ECIs may be incorporated without ambiguity by specifying the valid placements of ECI escape sequences.

5.5.3.1 ECIs and Text Compaction mode

An ECI escape sequence may be placed anywhere within Text Compaction mode. The sub-mode invoked immediately prior to the ECI escape sequence is preserved for the encodation immediately after it. Thus, sub-mode latches and shifts are preserved across an ECI escape sequence and thus a sub-mode shift immediately before an ECI escape sequence is not ignored.

5.5.3.2 ECIs and Byte Compaction mode using mode latch 924 and 901

If encoding in Byte Compaction mode using mode latch 924, an ECI escape sequence may be positioned by an encoder immediately following codeword 924, or at any 5-codeword boundary thereafter. This is necessary to provide an unambiguous position in the decoded byte stream for the decoder to place the escape sequence.

If the decoder is in the 924 version of Byte Compaction mode and finds an ECI escape sequence following a 5-codeword group, it shall output the six data bytes associated with the codewords before the escape sequence, output the escape sequence, and then continue collecting codewords for decoding in Byte Compaction mode. If the decoder encounters an ECI escape sequence at other than these prescribed locations, it shall treat the symbol as invalid.

If encoding in Byte Compaction mode using mode latch 901, an ECI escape sequence may be positioned

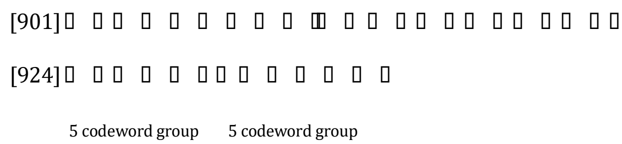
— immediately following codeword 901,

— immediately after any set of five codewords encoding six bytes, and

— immediately after any of the trailing single-byte codewords at the end of the sequence.

NOTE The decoder cannot assume that, just because the ECI escape sequence follows a set of five codewords, the five codewords encode six bytes, since an input stream of length 6N+5 (where N is an integer) will have a final set of five codewords that encode only five bytes, one byte per codeword. The decoder must, therefore, scan forward in the symbol past the ECI escape sequence to determine where the 901 mode terminates, as defined in 5.4.3.4. Based on this information, it can then determine how the group of five codewords have been encoded.

Figure 7 illustrates valid locations for ECI escape sequences when encoding in Byte Compaction mode. If the decoder encounters an ECI escape sequence within the 5-codeword group, it shall treat the symbol as invalid.



Key

- ◻ byte compaction mode codeword
- ◆ valid location for ECI escape sequence

Figure 7 — Valid Locations for ECI Escape Sequences in Byte Compaction Mode

5.5.3.3 ECIs and Byte Compaction using mode shift 913

If encoding in Byte Compaction mode using mode shift 913, an ECI escape sequence may be placed

— immediately preceding codeword 913,

— immediately following codeword 913, and

— immediately following the codeword after codeword 913.

In the first two cases, the ECI escape sequence is output before the encoded byte, while in the last case, the escape sequence is output following the encoded byte.

5.5.3.4 ECIs and Numeric Compaction mode

An ECI escape sequence shall not be placed within a group of codewords being processed through the base 10 to base 900 conversion as defined in 5.4.4.2. It may only be placed within a Numeric Compaction mode region at a boundary between (the typically) 15-codeword groups. This is necessary to provide an unambiguous position in the decoded digit stream for the decoder to place the escape sequence.

Thus, an ECI escape sequence may only be placed

— immediately after codeword 902,

— after the 15th codeword,

— after the 30th codeword, and

— etc.

If the encoder needs to place an ECI escape sequence at a location that does not result in a multiple of 15 codewords, it shall treat the numeric block before the ECI as a complete entity, as defined in 5.4.4.2 step 2. It shall re-invoke the Numeric Compaction mode by placing another codeword 902 in the stream followed by the ECI escape sequence.

If the decoder finds an ECI escape sequence on one of the boundary points defined above, it shall emit the data bytes associated with the codewords before the escape sequence (if any), then emit the escape sequence, and then continue collecting codewords for decoding in Numeric Compaction mode. If the decoder encounters an ECI escape sequence at other than the prescribed locations, it shall treat the symbol as invalid.

5.5.3.5 Combining ECIs

Two or more ECI escape sequences (e.g. assignment numbers) may be placed at any point where one ECI can be validly located; providing that no codewords, other than those used to encode the ECI escape sequence, are placed between them.

5.5.4 Post-decode protocol

The protocol for transmitting ECI data shall be as defined in 5.17.2. When transmitting ECIs, symbology identifiers (see 5.17.5) shall be fully implemented and the appropriate symbology identifier shall be transmitted as a preamble.

5.6 Determining the codeword sequence

The encoding process generates a sequence of codewords defined as:

$d_{n-1} \ldots d_0$

where

d is the data codeword including the Symbol Length Descriptor and all function codewords;

n is the total number of data (and pad) codewords including the Symbol Length Descriptor but excluding the error correction codewords.

The Symbol Length Descriptor shall be the first data codeword and designated d_{n-1}. Its value shall be equal to the total number of data codewords $\boldsymbol{n}$; this count shall include the Symbol Length Descriptor itself and thus shall be in the range of 1 to 926.

During the encoding process, sequences of codewords will be established. Like the original data itself, the most significant data shall appear first, for example, textual and numeric data reads from the left to the right. The sequence of codewords shall be that the most significant data codeword containing encoded data is the one designated d_{n-2}. The final data (or pad) codeword is the one designated d_0.

The process used to determine the symbol matrix of rows and columns (see 5.9.2) can require the addition of trailing pad codewords to the end of the data codeword sequence.

5.7 Error detection and correction

Each PDF417 symbol contains at least two error correction codewords. The Error Correction codewords provide capability for both error detection and correction.

5.7.1 Error correction level

The error correction level for a PDF417 symbol is selectable at the time of symbol creation. Table 9 shows the number of error correction codewords for each error correction level.

Table 9 — Error Correction Levels and Error Correction Codewords

Error Correction Level	Total Number of Error Correction Codewords
0	2
1	4
2	8
3	16
4	32
5	64
6	128
7	256
8	512

5.7.2 Error correction capacity

Error correction can be used to compensate for defects in the label and misreads during the decode procedure. For any given error correction level, a particular number of error correction codewords is incorporated into the PDF417 symbol. The error correction codeword algorithm used allows two types of error to be recovered:

— an **erasure**, which is a missing or undecodable codeword at a known position;

— a **substitution error**, which is an erroneously decoded codeword at an unknown position.

The error correction scheme requires one error correction codeword to rectify an erasure and two to recover a substitution error. Thus a given error correction level can rectify any combination of substitution errors and erasures which satisfy the following equations:

$$l + 2f \le 2^{s+1} - 2$$

where l, f and s are as defined in 4.1.

However, if most of the error correction capacity is used to correct erasures, the possibility of undetected errors is increased. For this reason, whenever there are fewer than 4 errors corrected (except when $s = 0$), the error correction capacity should be reduced as follows:

$$l + 2f \le 2^{s+1} - 3$$

where l, f and s are as defined in 4.1.

EXAMPLE A PDF417 symbol with error correction level 3 has 16 error correction codewords of which up to 14 can be used to correct errors and erasures. They can correct up to 13 erasures or 7 substitution errors, or any combination of l erasures and f substitution errors subject to the practical equations above. Table 10 specifies the possible combinations.

Table 10 — Possible Error Correction Combinations for Error Correction Level 3

Recovered Substitution Errors	Recovered Erasures	Determining Equation
0	13 or less	$l + 2f \le 2^{s+1} - 3$ (number of errors <4)
1	11 or less	
2	9 or less	
3	7 or less	
4	6 or less	$l + 2f \le 2^{s+1} - 2$ (number of errors ≥4)
5	4 or less	
6	2 or less	
7	0	

5.7.3 Defining the error correction codewords

A two-stage process must be performed to define the error correction codewords.

a) Selecting the error correction level. This is a user or application defined option and is described in Annex E.

b) Generating the error correction codewords. This is to a prescribed set of rules defined in 5.10. The procedures cannot be used until all the data codewords, including pad codewords (see 5.9.2) have been defined.

NOTE The procedures defined in 5.3 to 5.9, 5.13 and 5.14 are of prime interest to users. The more technical procedures defined in 5.10, 5.11 and 5.15 are likely to be achieved electronically and require no user decisions.

5.8 Dimensions

PDF417 symbols should conform with the following dimensions.

5.8.1 Minimum width of a module (X)

This should be defined by the application specification, having due regard to the availability of equipment for the production and reading of symbols and complying with the general requirements of the application.

The X dimension shall be constant throughout a given symbol.

NOTE Current bar code symbol quality measurement standards (e.g. ISO/IEC 15415) do not require absolute dimensional measurements to be taken into account for assessing symbol quality. Non-compliance with any minimum dimension should not therefore, by itself, be a reason for rejection of a symbol under these standards.

5.8.2 Row height (Y)

For symbols with at least the recommended minimum level of error correction:

$$Y \geq 3X$$

For symbols with less than the recommended minimum level of error correction, the row height may be increased, particularly when the X dimension is small. (See Annex E for details of the recommended error correction level).

5.8.3 Quiet zones

— Minimum width of horizontal quiet zone (to the left and right of the PDF417 symbol): $2X$

— Minimum size of vertical quiet zone (above and below the PDF417 symbol): $2X$

5.9 Defining the symbol format

The PDF417 symbol matrix, and the overall size and shape of the symbol, are determined by

a) the module width and aspect ratio, and

b) the number of rows and columns in the symbol matrix.

To create a PDF417 symbol, these parameters are selected through a combination of user inputs, application constraints, and default settings. The selection process can be iterative until the user is satisfied with the resultant format.

5.9.1 Defining the aspect ratio of the module

The aspect ratio of the printed module shall be defined by two dimensions:

— X is the desired dimension of the narrowest bar and narrowest space;

— Y is the desired dimension of the height of each row.

These parameters are defined by the user or application. The major factors that determine the values of these parameters are the resolutions of the printing and scanning systems used in the application. These points are discussed in 5.14.

5.9.2 Defining the symbol matrix of rows and columns

There are several factors which need to be considered in order to determine the symbol matrix, i.e. the number of rows *r* and the number of columns *c*:

— the amount and type of data to be encoded;

— the basic rules of the symbology which, for example, determine the limits on the number of rows and columns (see 5.2.1 and 5.2.2);

— the physical space available to print the symbol;

— the fact that longer rows result in the use of less symbol overhead (start and stop characters, row indicators and space for quiet zones);

— the fact that the length of the row (including the quiet zones) must be less than the length of the scan line prescribed or implied by the application;

— the type of scanner, which may determine the overall aspect ratio of the symbol;

— the selected level of error correction.

For many applications, the allowable width of the symbol is the primary constraint, and the symbol matrix can be directly determined by fixing the number of columns. Annex O provides more precise guidelines which should be used to define the symbol matrix.

After the source data has been encoded using the selected compaction modes, the number of source data codewords ***m*** (prior to the addition of the Symbol Length Descriptor and any pad codewords) is known. Once the number of rows and columns, and the error correction level, have been selected, the total number of data codewords ***n*** is calculated as:

$$n = c \times r - k$$

where *c*, *k*, *n* and *r* are as defined in 4.1.

The matrix can result in a situation where the number of rows and columns requires the use of pad codewords (by convention using value **900**). This occurs when:

$$n > m + 1$$

where *m* and *n* are as defined in 4.1.

The Symbol Length Descriptor shall be set to the value ***n*** determined above, thus:

$$d_{n-1} = n = c \times r - k$$

The number of pad codewords required is $(n - m) - 1$.

The pad codewords should have the value 900 and shall be placed in the least significant positions of the data codeword sequence, i.e. to the right of the least-significant source data codeword (but before the Macro PDF417 Control Block, if present). An example of this process is given below. Apart from the insertion of the Symbol Length Descriptor and any pad codewords, the codeword sequence shall remain identical to the one originally generated when encoding the source data.

EXAMPLE

let m = 246, c = 12, r = 24, and k = 32, then $n = (c \times r) - k = (12 \times 24) - 32 = 256$.

NOTE The notation is as defined above.

The value of the Symbol Length Descriptor is n = 256.

The number of pad codewords = $(n - m) - 1 = 256 - 246 - 1 = 9$. In this example, the data codewords (before padding) begin with a latch to Numeric Compaction mode (Codeword 902), and end with codeword 423, and the pads all use codeword 900. The addition of the Symbol Length Descriptor and pads is shown below:

Original data codeword sequence:		d_{m-1}	...	d_0
Codewords:		902	...	423

Padded data codeword sequence:	d_{n-1}	d_{n-2}	...	d_9	d_8	...	d_0
Codewords:	256	902	...	423	900	...	900

5.10 Generating the error correction codewords

The error correction codewords shall be generated using the procedure defined below. They are calculated on the basis of the values of all the data codewords including the Symbol Length Descriptor and any pad codewords. The codeword sequence is defined as:

$$d_{n-1}, d_{n-2}, \ldots d_0$$

where d_{n-1} is the Symbol Length Descriptor.

The symbol data polynomial is:

$$d(x) = d_{n-1}x^{n-1} + d_{n-2}x^{n-2} + \ldots + d_1 x + d_0$$

The following describes mathematically how the error correction codewords shall be computed for a given stream of data and a selected error correction level. All the arithmetic shall be done in modulo 929.

The error correction codewords are the complement of coefficients of the remainder resulting from dividing the symbol data polynomial $d(x)$ multiplied by x^k by the generator polynomial $g(x)$. Negative values are mapped into the Galois Field GF (929) by adding 929 until the value is ≥0.

The following generator polynomial shall be used to calculate coefficients for k error correction codewords required for the error correction level:

$$g_k(x) = (x - 3)(x - 3^2)(x - 3^3) \ldots (x - 3^k)$$

$$= \alpha_0 + \alpha_1 x + \alpha_2 x^2 + \ldots + \alpha_{k-1} x^{k-1} + x^k$$

where

$g_k(x)$ is the generator polynomial and x is the unknown variable;

k is the total number of error correction codewords;

α_j is the coefficient of powers of x produced by the generator polynomial $g_k(x)$

An example for calculating the coefficients is given in Annex Q.

Annex F contains all the coefficient values necessary to encode a PDF417 symbol of any error correction level.

The error correction codewords shall be calculated according to the algorithm defined below using the following notation:

d_i is the data codeword $d_{n-1} \dots d_0$;

E_j is the error correction codeword $E_{k-1} \dots E_0$;

α_j is the coefficient of powers of x taken from the generator polynomial (see above for an explanation and Annex F for the values);

t_1, t_2, t_3 are the temporary variables.

The algorithm is as follows.

a) Identify the data codeword sequence $d_{n-1}, d_{n-2} \dots d_0$.

b) Initialise error correction codewords $E_0, \dots, E_{k-1}$ to value = 0.

c) For each data codeword $d_i = d_{n-1} \dots d_0$:

BEGIN

$t_1 = (d_i + E_{k-1}) \bmod 929$

For each error correction codeword $E_j = E_{k-1} \dots E_1$:

BEGIN

$t_2 = (t_1 \times \alpha_j) \bmod 929$

$t_3 = 929 - t_2$

$E_j = (E_{j-1} + t_3) \bmod 929$

END

$t_2 = (t_1 \times \alpha_0) \bmod 929$

$t_3 = 929 - t_2$

$E_0 = t_3 \bmod 929$

END

d) For each error correction codeword, $E_j = E_0 \dots E_{k-1}$, calculate the complement:

BEGIN

If E_j not equal to 0

$E_j = 929 - E_j$

END

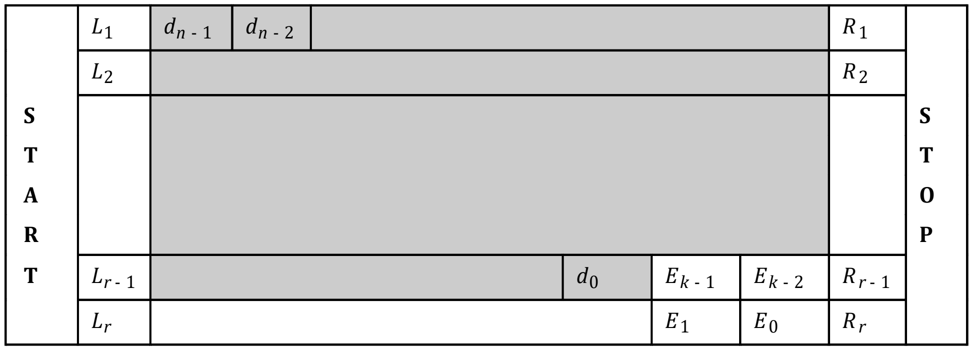
An example of calculating the error correction codewords is given in Annex Q.

An alternative procedure for generating the error correction codewords, using a division circuit, is given in Annex R.

5.11 Low level encodation

Low level encoding converts the codewords into their corresponding symbol characters (bar-space sequence) given that the symbol matrix has been fixed.

Figure 8 illustrates schematically for a PDF417 symbol the corresponding position of each data codeword, error correction codeword and row indicators.



Key

L_r	left row indicator
R_r	right row indicator
shaded area	data codeword area
Unshaded area under the codeword area	for error correction codewords

Figure 8 — Typical PDF417 Symbol Schematic Showing the Positioning of Codewords

5.11.1 Clusters

PDF417 uses a system of local row discrimination to detect row-to-row transitions.

The set of codewords is represented in each of three clusters. Cluster numbers 0, 3 and 6 are used. The associated bar-space sequences of each symbol character representing each codeword and cluster are given in Annex A.

To encode the row indicators and codewords, each row shall contain the symbol characters (bar-space patterns) of only one cluster. Row 1 shall use symbol characters from cluster 0, row 2 shall use symbol characters from cluster 3, row 3 shall use symbol characters from cluster 6, row 4 shall use symbol characters from cluster 0 and so forth. The cluster sequence 0, 3, 6 shall repeat continually. The cluster number K for any row can be calculated:

$$K = \left[\left(rownumber - 1 \right) \bmod 3 \right] \times 3$$

where the rows are numbered 1 to r (as defined in 4.1).

Because any two adjacent rows have different clusters, the decoder can utilise scans that cross rows while decoding a PDF417 symbol.

5.11.2 Determining the symbol matrix

The symbol matrix of rows and columns shall be finally determined by the procedures set out in 5.9.2. This provides the values of r and c.

5.11.3 Determining the values of the left and right row indicators

The row indicators in a PDF417 symbol are codewords which encode several key parameters: the row number (F), the number of rows (r), the number of columns (c) and the error correction level (s). The information shall be spread over three rows and the cycle shall repeat continually. The row number (F) shall be encoded in each row.

5.11.3.1 Left row indicators

Left row indicators shall be calculated as follows:

If $K_F = 0$; $L_F = 30 \times [(F - 1) \text{ div } 3] + (r - 1) \text{ div } 3$

If $K_F = 3$; $L_F = 30 \times [(F - 1) \text{ div } 3] + (s \times 3) + (r - 1) \text{ mod } 3$

If $K_F = 6$; $L_F = 30 \times [(F - 1) \text{ div } 3] + (c - 1)$

where c, F, r, s and K are as defined in 4.1

5.11.3.2 Right row indicators

Right row indicators shall be calculated as follows:

If $K_F = 0$; $R_F = 30 \times [(F - 1) \text{ div } 3] + (c - 1)$

If $K_F = 3$; $R_F = 30 \times [(F - 1) \text{ div } 3] + (r - 1) \text{ div } 3$

If $K_F = 6$; $R_F = 30 \times [(F - 1) \text{ div } 3) + (s \times 3] + (r - 1) \text{ mod } 3$

where c, F, r, s, and K are as defined in 4.1.

5.11.4 Row encoding

In each row, the following symbol characters shall conform with the cluster number:

— left row indicator;

— symbol characters representing data and/or error correction codewords to a number equal to the number of columns;

— right row indicator.

The start and stop characters are constant for all rows.

The symbol shall be encoded row by row, taking c (the number of columns) codewords into each row. The first row shall include the Symbol Length Descriptor in the first column. The last row shall include some or all of the error correction codewords.

5.12 Compact PDF417

Compact PDF417 symbols are an available option. If used, Compact PDF417 shall conform with Annex G.

5.13 Macro PDF417

Macro PDF417 provides a mechanism for the data in a file to be split into blocks and be represented in more than one PDF417 symbol. This mechanism is similar to the Structured Append feature in other symbologies.

Each Macro PDF417 symbol shall contain additional control information to enable the original data file to be properly reconstructed, irrespective of the sequence in which the individual PDF417 symbols are scanned and decoded.

Up to 99 999 individual PDF417 symbols may be used to encode data in Macro PDF417.

Full details of the procedures of Macro PDF417 are given in Annex H.

5.13.1 Compaction modes and Macro PDF417

The Macro PDF417 Control Block has a predefined encoding method, so codeword 928 causes the termination of any compaction mode sequence in the body of the symbol. The Segment Index field shall be encoded in Numeric Compaction mode. Each defined Macro PDF417 optional field has a specific, implied initial compaction mode and sub-mode, and the beginning of a new optional field serves to terminate the compaction mode from the previous field (see H.2.3) and initiates its default mode. Specifically, even if two consecutive optional fields both use the Text Compaction mode, the Alpha sub-mode is reset when codeword 923 is encountered.

5.13.2 ECIs and Macro PDF417

Subject to the constraints defined in 5.5.2, ECIs may occur in the message encoded in a single or Macro PDF417 set of symbols. Any ECI invoked shall apply until the end of the encoded data, or until another ECI is encountered. Thus, the interpretation of the ECI may straddle two or more symbols.

The ECI interpretation(s) in the body of the data codeword stream do not extend into the Macro PDF417 Control Block but resume automatically at the beginning of the next symbol. The Control Block's data is interpreted using the default ECI (000003), unless ECI escape sequences are explicitly encoded in an optional field in the Control Block; the effect of any such ECI is automatically terminated at the end of the field in which it appears.

NOTE When implemented as GLIs according to earlier specifications (e.g. the original AIM USA (1994) and AIM Europe (1994) PDF417 specifications), encodation implies a return to GLI 0 (equivalent to ECI 000000) at the start of each symbol. If it is intended for a GLI 1 to persist into the next symbol, then GLI 1 shall be explicitly encoded at the start of this next symbol. As encoders compliant with these earlier standards will be in use for some time, advice is given in 5.17.6 on how to achieve compatibility with this specification.

5.14 User guidelines

5.14.1 Human readable interpretation

PDF417 symbols are capable of encoding large amounts of data, which means that a human readable interpretation of the data characters may not be practical. As an alternative, descriptive text, rather than literal text, may accompany the symbol. The message may be printed anywhere in the area surrounding the symbol, but should not interfere with the symbol itself nor the quiet zones. Font and character size are not specified by this International Standard, but may be by application standards.

5.14.2 Autodiscrimination capability

PDF417 can be used in an autodiscrimination environment with a number of other symbologies (see S.1).

5.14.3 User-defined application parameters

Application standards shall define parameters of PDF417 symbols specified in this International Standard as variable, as follows:

5.14.3.1 Symbology and dimensional characteristics

Application standards shall specify the following data, symbology and dimensional parameters:

a) the selection and use of Extended Channel Interpretations, if required, to extend data encodation beyond the default interpretations of the basic modes;

b) the volume of data in the symbol, which may be fixed, variable or variable up to a defined maximum;

c) the selection of the error correction level;

d) range of *X*-dimension;

e) range of *Y*-dimension;

f) symbol parameters: the range of permissible aspect ratios and/or whether symbol width or height has a maximum size.

NOTE Additional factors which should be taken into consideration when specifying PDF417 applications are given in Annexes O and S.

5.14.3.2 Test specification

The parameters for the evaluation of symbols shall be defined by specifying a quality grade in accordance with ISO/IEC 15415 in the application standard.

This grade is expressed in the form:

grade/aperture/peakresponse wavelength

The following example illustrates the types of value which need to be expressed:

1,5/10/660

where

1,5 is the overall symbol quality grade;

10 is the measuring aperture reference number (in this example 0,25 mm diameter);

660 is the peak response wavelength in nanometres.

NOTE ISO/IEC 15415 gives guidance on selection of grading parameters in application specifications. The values appropriate for the application shall be defined in the application standard.

5.14.4 PDF417 symbol quality

PDF417 symbols shall be assessed for quality using the 2D bar code symbol print quality guidelines defined in ISO/IEC 15415 for multi-row symbols with cross-row scanning capability.

5.15 Reference decode algorithm

The reference decode algorithm for PDF417 is defined in Annex J. This reference decode algorithm is the basis for print quality assessment according to ISO/IEC 15415.

5.16 Error detection and error correction procedure

As part of the decode procedure, it is possible to reconstruct the symbol for erasures and substitution errors within the error correction capacity of the symbol. This can be done by using the procedure set out in Annex K.

5.17 Transmitted data

5.17.1 Transmitted data in the basic (default) interpretation

All data codewords shall be translated into user data and transmitted as 8-bit bytes, whether this data is encoded in Text Compaction, Byte Compaction or Numeric Compaction mode. Start and stop characters, row indicators, the Symbol Length Descriptor, mode switching codewords, pad codewords and error correction codewords are not transmitted.

5.17.2 Transmission protocol for Extended Channel Interpretation (ECI)

In systems where ECIs are supported, a symbology identifier prefix shall be used with every transmission (see 5.17.5 and Annex L). Macro PDF417 Control Blocks (if transmitted) shall be treated as part of a control set of escape sequences which operate in conjunction with the ECI transmission protocol (see 5.17.3 and Annex H).

Three codewords (925, 926 and 927) signal the encodation of an ECI value and are decoded as byte values as follows.

a) If the ECI sequence begins with codeword 927:

   1) codeword 927 is transmitted as the escape character 92, which represents reverse solidus (\), or backslash, in the default encodation;

   2) the next codeword is converted into a 6-digit value, by placing leading zeros before the codeword. The 6-digit value is transmitted as the six corresponding byte values in the range, 48 to 57.

   EXAMPLE

   Symbol encodes: [927] [123]

   Data transmission (byte): 92, 48, 48, 48, 49, 50, 51

   ASCII interpretation: \000123

b) If the ECI sequence begins with codeword 926:

   1) codeword 926 is transmitted as escape character 92;

   2) the next two codewords are converted into a 6-digit value, with leading zeros if required, using the following formula:

   [(1st codeword) +1] × 900 + (2nd codeword)

   The 6-digit value is transmitted as the six corresponding byte values in the range, 48 to 57.

   EXAMPLE

   Symbol encodes: [926] [136] [156]

   Data transmission (bytes): 92, 49, 50, 51, 52, 53, 54

   ASCII interpretation: \123456

c) If the ECI sequence begins with codeword 925:

   1) codeword 925 is transmitted as escape character 92;

   2) the next codeword is converted into a 6-digit value by adding the value 810 900 to it. The 6-digit value is transmitted as the six corresponding byte values in the range, 48 to 57.

   EXAMPLE

   Symbol encodes: [925] [456]

   Data transmission (byte): 92, 56, 49, 49, 51, 53, 54

   ASCII interpretation: \811356

The procedure is repeated for each occurrence of Extended Channel Interpretation (ECI).

Application software recognising the 7-byte escape sequence of 92 followed by six bytes (each in the range 48 to 57) should interpret all subsequent characters until the end of the encoded data, or until another single byte 92 is encountered, as being from the ECI defined by the 6-digit sequence.

If the reverse solidus, or other character represented by byte 92 needs to be used as encoded data, transmission shall be as follows. Whenever byte 92 occurs as data, two bytes of that value shall be transmitted; thus a single occurrence is always an escape character and a double occurrence indicates true data.

EXAMPLE

Encoded data: A\\B\C

Transmission: A\\\\B\\C

5.17.3 Transmitted data for Macro PDF417

The protocol for transmitted data for Macro PDF417 is included in H.6.

5.17.4 Transmission of reserved codewords using the ECI protocol

When operating under the ECI transmission protocol, PDF417 decoders should transmit a reserved codeword escape sequence of six bytes (interpreted as '\CnnnC'), representing escape character (92) followed by 'C' (67), three digits which represent the decimal value of the reserved codeword, followed by another 'C', which terminates the escape sequence in a symbology-independent manner. The data codewords which follow the reserved codeword are not interpreted by the decoder according to any compaction mode, but instead are transmitted as a series of escape sequences representing the codewords using the same 6-byte escape sequence defined earlier in this paragraph. All remaining data codewords are transmitted in this manner, until one of the following is reached:

— the end of the encoded data in the symbol;

— a latch to a recognised compaction mode;

— a Macro PDF417 Control Block function codeword (928, 923, or 922).

Codeword 913 (Byte shift) is only permitted from Text Compaction mode, and thus shall not be part of the codeword stream while in this process of sending escaped uninterpreted codewords.

NOTE This protocol can properly transmit the message syntax of any reserved codeword whose future definition is to provide either a signalling function or to represent a new compaction mode.

5.17.5 Symbology identifier

Once the structure of the data (in terms of Macro PDF417, ECI, etc) has been identified, the appropriate symbology identifier should be added as a preamble to the transmitted data by the decoder. See Annex L for the symbology identifiers which apply to PDF417.

5.17.6 Transmission using older protocols

The introduction of the Extended Channel Interpretation system, common to a number of symbologies, has had an impact on pre-existing symbologies including PDF417. The basic encoding and decoding rules remain identical in this International Standard to those in the original AIM USA (1994) and AIM Europe (1994) PDF417 specifications. Transmission for both ECIs and Macro PDF417 is different in format, but conveys equivalent information.

All new PDF417 decoding equipment and software should conform with this International Standard. However, equipment conforming with the earlier standard will still be in existence for a number of years. Annex M defines the rules which shall be followed when using decoding equipment and software not capable of being compliant with the current ECI and Macro PDF417 symbols. In this way, old and new decoding equipment can continue to co-exist.

Annex A
(normative)

Encoding/decoding table of PDF417 symbol character bar-space sequences

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
0	31111136	51111125	21111155
1	41111144	61111133	31111163
2	51111152	41111216	11111246
3	31111235	51111224	21111254
4	41111243	61111232	31111262
5	51111251	41111315	11111345
6	21111326	51111323	21111353
7	31111334	61111331	31111361
8	21111425	41111414	11111444
9	11111516	51111422	21111452
10	21111524	41111513	11111543
11	11111615	51111521	61112114
12	21112136	41111612	11112155
13	31112144	41112125	21112163
14	41112152	51112133	61112213
15	21112235	61112141	11112254
16	31112243	31112216	21112262
17	41112251	41112224	61112312
18	11112326	51112232	11112353
19	21112334	31112315	21112361
20	11112425	41112323	61112411
21	11113136	51112331	11112452
22	21113144	31112414	51113114
23	31113152	41112422	61113122
24	11113235	31112513	11113163
25	21113243	41112521	51113213
26	31113251	31112612	61113221
27	11113334	31113125	11113262
28	21113342	41113133	51113312
29	11114144	51113141	11113361
30	21114152	21113216	51113411
31	11114243	31113224	41114114
32	21114251	41113232	51114122
33	11115152	21113315	41114213

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
34	51116111	31113323	51114221
35	31121135	41113331	41114312
36	41121143	21113414	41114411
37	51121151	31113422	31115114
38	21121226	21113513	41115122
39	31121234	31113521	31115213
40	41121242	21113612	41115221
41	21121325	21114125	31115312
42	31121333	31114133	31115411
43	11121416	41114141	21116114
44	21121424	11114216	31116122
45	31121432	21114224	21116213
46	11121515	31114232	31116221
47	21121523	11114315	21116312
48	11121614	21114323	11121146
49	21122135	31114331	21121154
50	31122143	11114414	31121162
51	41122151	21114422	11121245
52	11122226	11114513	21121253
53	21122234	21114521	31121261
54	31122242	11115125	11121344
55	11122325	21115133	21121352
56	21122333	31115141	11121443
57	31122341	11115224	21121451
58	11122424	21115232	11121542
59	21122432	11115323	61122113
60	11123135	21115331	11122154
61	21123143	11115422	21122162
62	31123151	11116133	61122212
63	11123234	21116141	11122253
64	21123242	11116232	21122261
65	11123333	11116331	61122311
66	21123341	41121116	11122352
67	11124143	51121124	11122451
68	21124151	61121132	51123113
69	11124242	41121215	61123121
70	11124341	51121223	11123162
71	21131126	61121231	51123212
72	31131134	41121314	11123261
73	41131142	51121322	51123311
74	21131225	41121413	41124113
75	31131233	51121421	51124121

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
76	41131241	41121512	41124212
77	11131316	41121611	41124311
78	21131324	31122116	31125113
79	31131332	41122124	41125121
80	11131415	51122132	31125212
81	21131423	31122215	31125311
82	11131514	41122223	21126113
83	11131613	51122231	31126121
84	11132126	31122314	21126212
85	21132134	41122322	21126311
86	31132142	31122413	11131145
87	11132225	41122421	21131153
88	21132233	31122512	31131161
89	31132241	31122611	11131244
90	11132324	21123116	21131252
91	21132332	31123124	11131343
92	11132423	41123132	21131351
93	11132522	21123215	11131442
94	11133134	31123223	11131541
95	21133142	41123231	61132112
96	11133233	21123314	11132153
97	21133241	31123322	21132161
98	11133332	21123413	61132211
99	11134142	31123421	11132252
100	21141125	21123512	11132351
101	31141133	21123611	51133112
102	41141141	11124116	11133161
103	11141216	21124124	51133211
104	21141224	31124132	41134112
105	31141232	11124215	41134211
106	11141315	21124223	31135112
107	21141323	31124231	31135211
108	31141331	11124314	21136112
109	11141414	21124322	21136211
110	21141422	11124413	11141144
111	11141513	21124421	21141152
112	21141521	11124512	11141243
113	11142125	11125124	21141251
114	21142133	21125132	11141342
115	31142141	11125223	11141441
116	11142224	21125231	61142111
117	21142232	11125322	11142152

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
118	11142323	11125421	11142251
119	21142331	11126132	51143111
120	11142422	11126231	41144111
121	11142521	41131115	31145111
122	21143141	51131123	11151143
123	11143331	61131131	21151151
124	11151116	41131214	11151242
125	21151124	51131222	11151341
126	31151132	41131313	11152151
127	11151215	51131321	11161142
128	21151223	41131412	11161241
129	31151231	41131511	12111146
130	11151314	31132115	22111154
131	21151322	41132123	32111162
132	11151413	51132131	12111245
133	21151421	31132214	22111253
134	11151512	41132222	32111261
135	11152124	31132313	12111344
136	11152223	41132321	22111352
137	11152322	31132412	12111443
138	11161115	31132511	22111451
139	31161131	21133115	12111542
140	21161222	31133123	62112113
141	21161321	41133131	12112154
142	11161511	21133214	22112162
143	32111135	31133222	62112212
144	42111143	21133313	12112253
145	52111151	31133321	22112261
146	22111226	21133412	62112311
147	32111234	21133511	12112352
148	42111242	11134115	12112451
149	22111325	21134123	52113113
150	32111333	31134131	62113121
151	42111341	11134214	12113162
152	12111416	21134222	52113212
153	22111424	11134313	12113261
154	12111515	21134321	52113311
155	22112135	11134412	42114113
156	32112143	11134511	52114121
157	42112151	11135123	42114212
158	12112226	21135131	42114311
159	22112234	11135222	32115113

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
160	32112242	11135321	42115121
161	12112325	11136131	32115212
162	22112333	41141114	32115311
163	12112424	51141122	22116113
164	12112523	41141213	32116121
165	12113135	51141221	22116212
166	22113143	41141312	22116311
167	32113151	41141411	21211145
168	12113234	31142114	31211153
169	22113242	41142122	41211161
170	12113333	31142213	11211236
171	12113432	41142221	21211244
172	12114143	31142312	31211252
173	22114151	31142411	11211335
174	12114242	21143114	21211343
175	12115151	31143122	31211351
176	31211126	21143213	11211434
177	41211134	31143221	21211442
178	51211142	21143312	11211533
179	31211225	21143411	21211541
180	41211233	11144114	11211632
181	51211241	21144122	12121145
182	21211316	11144213	22121153
183	31211324	21144221	32121161
184	41211332	11144312	11212145
185	21211415	11144411	12121244
186	31211423	11145122	22121252
187	41211431	11145221	11212244
188	21211514	41151113	21212252
189	31211522	51151121	22121351
190	22121126	41151212	11212343
191	32121134	41151311	12121442
192	42121142	31152113	11212442
193	21212126	41152121	12121541
194	22121225	31152212	11212541
195	32121233	31152311	62122112
196	42121241	21153113	12122153
197	21212225	31153121	22122161
198	31212233	21153212	61213112
199	41212241	21153311	62122211
200	11212316	11154113	11213153
201	12121415	21154121	12122252

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
202	22121423	11154212	61213211
203	32121431	11154311	11213252
204	11212415	41161112	12122351
205	21212423	41161211	11213351
206	11212514	31162112	52123112
207	12122126	31162211	12123161
208	22122134	21163112	51214112
209	32122142	21163211	52123211
210	11213126	42111116	11214161
211	12122225	52111124	51214211
212	22122233	62111132	42124112
213	32122241	42111215	41215112
214	11213225	52111223	42124211
215	21213233	62111231	41215211
216	31213241	42111314	32125112
217	11213324	52111322	31216112
218	12122423	42111413	32125211
219	11213423	52111421	31216211
220	12123134	42111512	22126112
221	22123142	42111611	22126211
222	11214134	32112116	11221136
223	12123233	42112124	21221144
224	22123241	52112132	31221152
225	11214233	32112215	11221235
226	21214241	42112223	21221243
227	11214332	52112231	31221251
228	12124142	32112314	11221334
229	11215142	42112322	21221342
230	12124241	32112413	11221433
231	11215241	42112421	21221441
232	31221125	32112512	11221532
233	41221133	32112611	11221631
234	51221141	22113116	12131144
235	21221216	32113124	22131152
236	31221224	42113132	11222144
237	41221232	22113215	12131243
238	21221315	32113223	22131251
239	31221323	42113231	11222243
240	41221331	22113314	21222251
241	21221414	32113322	11222342
242	31221422	22113413	12131441
243	21221513	32113421	11222441

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
244	21221612	22113512	62132111
245	22131125	22113611	12132152
246	32131133	12114116	61223111
247	42131141	22114124	11223152
248	21222125	32114132	12132251
249	22131224	12114215	11223251
250	32131232	22114223	52133111
251	11222216	32114231	51224111
252	12131315	12114314	42134111
253	31222232	22114322	41225111
254	32131331	12114413	32135111
255	11222315	22114421	31226111
256	12131414	12114512	22136111
257	22131422	12115124	11231135
258	11222414	22115132	21231143
259	21222422	12115223	31231151
260	22131521	22115231	11231234
261	12131612	12115322	21231242
262	12132125	12115421	11231333
263	22132133	12116132	21231341
264	32132141	12116231	11231432
265	11223125	51211115	11231531
266	12132224	61211123	12141143
267	22132232	11211164	22141151
268	11223224	51211214	11232143
269	21223232	61211222	12141242
270	22132331	11211263	11232242
271	11223323	51211313	12141341
272	12132422	61211321	11232341
273	12132521	11211362	12142151
274	12133133	51211412	11233151
275	22133141	51211511	11241134
276	11224133	42121115	21241142
277	12133232	52121123	11241233
278	11224232	62121131	21241241
279	12133331	41212115	11241332
280	11224331	42121214	11241431
281	11225141	61212131	12151142
282	21231116	41212214	11242142
283	31231124	51212222	12151241
284	41231132	52121321	11242241
285	21231215	41212313	11251133

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
286	31231223	42121412	21251141
287	41231231	41212412	11251232
288	21231314	42121511	11251331
289	31231322	41212511	12161141
290	21231413	32122115	11252141
291	31231421	42122123	11261132
292	21231512	52122131	11261231
293	21231611	31213115	13111145
294	12141116	32122214	23111153
295	22141124	42122222	33111161
296	32141132	31213214	13111244
297	11232116	41213222	23111252
298	12141215	42122321	13111343
299	22141223	31213313	23111351
300	32141231	32122412	13111442
301	11232215	31213412	13111541
302	21232223	32122511	63112112
303	31232231	31213511	13112153
304	11232314	22123115	23112161
305	12141413	32123123	63112211
306	22141421	42123131	13112252
307	11232413	21214115	13112351
308	21232421	22123214	53113112
309	11232512	32123222	13113161
310	12142124	21214214	53113211
311	22142132	31214222	43114112
312	11233124	32123321	43114211
313	12142223	21214313	33115112
314	22142231	22123412	33115211
315	11233223	21214412	23116112
316	21233231	22123511	23116211
317	11233322	21214511	12211136
318	12142421	12124115	22211144
319	11233421	22124123	32211152
320	11234132	32124131	12211235
321	11234231	11215115	22211243
322	21241115	12124214	32211251
323	31241123	22124222	12211334
324	41241131	11215214	22211342
325	21241214	21215222	12211433
326	31241222	22124321	22211441
327	21241313	11215313	12211532

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
328	31241321	12124412	12211631
329	21241412	11215412	13121144
330	21241511	12124511	23121152
331	12151115	12125123	12212144
332	22151123	22125131	13121243
333	32151131	11216123	23121251
334	11242115	12125222	12212243
335	12151214	11216222	22212251
336	22151222	12125321	12212342
337	11242214	11216321	13121441
338	21242222	12126131	12212441
339	22151321	51221114	63122111
340	11242313	61221122	13122152
341	12151412	11221163	62213111
342	11242412	51221213	12213152
343	12151511	61221221	13122251
344	12152123	11221262	12213251
345	11243123	51221312	53123111
346	11243222	11221361	52214111
347	11243321	51221411	43124111
348	31251122	42131114	42215111
349	31251221	52131122	33125111
350	21251411	41222114	32216111
351	22161122	42131213	23126111
352	12161213	52131221	21311135
353	11252213	41222213	31311143
354	11252312	51222221	41311151
355	11252411	41222312	11311226
356	23111126	42131411	21311234
357	33111134	41222411	31311242
358	43111142	32132114	11311325
359	23111225	42132122	21311333
360	33111233	31223114	31311341
361	13111316	32132213	11311424
362	23111324	42132221	21311432
363	33111332	31223213	11311523
364	13111415	41223221	21311531
365	23111423	31223312	11311622
366	13111514	32132411	12221135
367	13111613	31223411	22221143
368	13112126	22133114	32221151
369	23112134	32133122	11312135

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
370	33112142	21224114	12221234
371	13112225	22133213	22221242
372	23112233	32133221	11312234
373	33112241	21224213	21312242
374	13112324	31224221	22221341
375	23112332	21224312	11312333
376	13112423	22133411	12221432
377	13112522	21224411	11312432
378	13113134	12134114	12221531
379	23113142	22134122	11312531
380	13113233	11225114	13131143
381	23113241	12134213	23131151
382	13113332	22134221	12222143
383	13114142	11225213	13131242
384	13114241	21225221	11313143
385	32211125	11225312	12222242
386	42211133	12134411	13131341
387	52211141	11225411	11313242
388	22211216	12135122	12222341
389	32211224	11226122	11313341
390	42211232	12135221	13132151
391	22211315	11226221	12223151
392	32211323	51231113	11314151
393	42211331	61231121	11321126
394	22211414	11231162	21321134
395	32211422	51231212	31321142
396	22211513	11231261	11321225
397	32211521	51231311	21321233
398	23121125	42141113	31321241
399	33121133	52141121	11321324
400	43121141	41232113	21321332
401	22212125	51232121	11321423
402	23121224	41232212	21321431
403	33121232	42141311	11321522
404	12212216	41232311	11321621
405	13121315	32142113	12231134
406	32212232	42142121	22231142
407	33121331	31233113	11322134
408	12212315	32142212	12231233
409	22212323	31233212	22231241
410	23121422	32142311	11322233
411	12212414	31233311	21322241

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
412	13121513	22143113	11322332
413	12212513	32143121	12231431
414	13122125	21234113	11322431
415	23122133	31234121	13141142
416	33122141	21234212	12232142
417	12213125	22143311	13141241
418	13122224	21234311	11323142
419	32213141	12144113	12232241
420	12213224	22144121	11323241
421	22213232	11235113	11331125
422	23122331	12144212	21331133
423	12213323	11235212	31331141
424	13122422	12144311	11331224
425	12213422	11235311	21331232
426	13123133	12145121	11331323
427	23123141	11236121	21331331
428	12214133	51241112	11331422
429	13123232	11241161	11331521
430	12214232	51241211	12241133
431	13123331	42151112	22241141
432	13124141	41242112	11332133
433	12215141	42151211	12241232
434	31311116	41242211	11332232
435	41311124	32152112	12241331
436	51311132	31243112	11332331
437	31311215	32152211	13151141
438	41311223	31243211	12242141
439	51311231	22153112	11333141
440	31311314	21244112	11341124
441	41311322	22153211	21341132
442	31311413	21244211	11341223
443	41311421	12154112	21341231
444	31311512	11245112	11341322
445	22221116	12154211	11341421
446	32221124	11245211	12251132
447	42221132	51251111	11342132
448	21312116	42161111	12251231
449	22221215	41252111	11342231
450	41312132	32162111	11351123
451	42221231	31253111	21351131
452	21312215	22163111	11351222
453	31312223	21254111	11351321

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
454	41312231	43111115	12261131
455	21312314	53111123	11352131
456	22221413	63111131	11361122
457	32221421	43111214	11361221
458	21312413	53111222	14111144
459	31312421	43111313	24111152
460	22221611	53111321	14111243
461	13131116	43111412	24111251
462	23131124	43111511	14111342
463	33131132	33112115	14111441
464	12222116	43112123	14112152
465	13131215	53112131	14112251
466	23131223	33112214	54113111
467	33131231	43112222	44114111
468	11313116	33112313	34115111
469	12222215	43112321	24116111
470	22222223	33112412	13211135
471	32222231	33112511	23211143
472	11313215	23113115	33211151
473	21313223	33113123	13211234
474	31313231	43113131	23211242
475	23131421	23113214	13211333
476	11313314	33113222	23211341
477	12222413	23113313	13211432
478	22222421	33113321	13211531
479	11313413	23113412	14121143
480	13131611	23113511	24121151
481	13132124	13114115	13212143
482	23132132	23114123	14121242
483	12223124	33114131	13212242
484	13132223	13114214	14121341
485	23132231	23114222	13212341
486	11314124	13114313	14122151
487	12223223	23114321	13213151
488	22223231	13114412	12311126
489	11314223	13114511	22311134
490	21314231	13115123	32311142
491	13132421	23115131	12311225
492	12223421	13115222	22311233
493	13133132	13115321	32311241
494	12224132	13116131	12311324
495	13133231	52211114	22311332

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
496	11315132	62211122	12311423
497	12224231	12211163	22311431
498	31321115	52211213	12311522
499	41321123	62211221	12311621
500	51321131	12211262	13221134
501	31321214	52211312	23221142
502	41321222	12211361	12312134
503	31321313	52211411	13221233
504	41321321	43121114	23221241
505	31321412	53121122	12312233
506	31321511	42212114	13221332
507	22231115	43121213	12312332
508	32231123	53121221	13221431
509	42231131	42212213	12312431
510	21322115	52212221	14131142
511	22231214	42212312	13222142
512	41322131	43121411	14131241
513	21322214	42212411	12313142
514	31322222	33122114	13222241
515	32231321	43122122	12313241
516	21322313	32213114	21411125
517	22231412	33122213	31411133
518	21322412	43122221	41411141
519	22231511	32213213	11411216
520	21322511	42213221	21411224
521	13141115	32213312	31411232
522	23141123	33122411	11411315
523	33141131	32213411	21411323
524	12232115	23123114	31411331
525	13141214	33123122	11411414
526	23141222	22214114	21411422
527	11323115	23123213	11411513
528	12232214	33123221	21411521
529	22232222	22214213	11411612
530	23141321	32214221	12321125
531	11323214	22214312	22321133
532	21323222	23123411	32321141
533	13141412	22214411	11412125
534	11323313	13124114	12321224
535	12232412	23124122	22321232
536	13141511	12215114	11412224
537	12232511	13124213	21412232

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
538	13142123	23124221	22321331
539	23142131	12215213	11412323
540	12233123	22215221	12321422
541	13142222	12215312	11412422
542	11324123	13124411	12321521
543	12233222	12215411	11412521
544	13142321	13125122	13231133
545	11324222	12216122	23231141
546	12233321	13125221	12322133
547	13143131	12216221	13231232
548	11325131	61311113	11413133
549	31331114	11311154	12322232
550	41331122	21311162	13231331
551	31331213	61311212	11413232
552	41331221	11311253	12322331
553	31331312	21311261	11413331
554	31331411	61311311	14141141
555	22241114	11311352	13232141
556	32241122	11311451	12323141
557	21332114	52221113	11414141
558	22241213	62221121	11421116
559	32241221	12221162	21421124
560	21332213	51312113	31421132
561	31332221	61312121	11421215
562	21332312	11312162	21421223
563	22241411	12221261	31421231
564	21332411	51312212	11421314
565	13151114	52221311	21421322
566	23151122	11312261	11421413
567	12242114	51312311	21421421
568	13151213	43131113	11421512
569	23151221	53131121	11421611
570	11333114	42222113	12331124
571	12242213	43131212	22331132
572	22242221	41313113	11422124
573	11333213	51313121	12331223
574	21333221	43131311	22331231
575	13151411	41313212	11422223
576	11333312	42222311	21422231
577	12242411	41313311	11422322
578	11333411	33132113	12331421
579	12243122	43132121	11422421

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
580	11334122	32223113	13241132
581	11334221	33132212	12332132
582	41341121	31314113	13241231
583	31341311	32223212	11423132
584	32251121	33132311	12332231
585	22251212	31314212	11423231
586	22251311	32223311	11431115
587	13161113	31314311	21431123
588	12252113	23133113	31431131
589	11343113	33133121	11431214
590	13161311	22224113	21431222
591	12252311	23133212	11431313
592	24111125	21315113	21431321
593	14111216	22224212	11431412
594	24111224	23133311	11431511
595	14111315	21315212	12341123
596	24111323	22224311	22341131
597	34111331	21315311	11432123
598	14111414	13134113	12341222
599	24111422	23134121	11432222
600	14111513	12225113	12341321
601	24111521	13134212	11432321
602	14112125	11316113	13251131
603	24112133	12225212	12342131
604	34112141	13134311	11433131
605	14112224	11316212	11441114
606	24112232	12225311	21441122
607	14112323	11316311	11441213
608	24112331	13135121	21441221
609	14112422	12226121	11441312
610	14112521	61321112	11441411
611	14113133	11321153	12351122
612	24113141	21321161	11442122
613	14113232	61321211	12351221
614	14113331	11321252	11442221
615	14114141	11321351	11451113
616	23211116	52231112	21451121
617	33211124	12231161	11451212
618	43211132	51322112	11451311
619	23211215	52231211	12361121
620	33211223	11322161	11452121
621	23211314	51322211	15111143

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
622	33211322	43141112	25111151
623	23211413	42232112	15111242
624	33211421	43141211	15111341
625	23211512	41323112	15112151
626	14121116	42232211	14211134
627	24121124	41323211	24211142
628	34121132	33142112	14211233
629	13212116	32233112	24211241
630	14121215	33142211	14211332
631	33212132	31324112	14211431
632	34121231	32233211	15121142
633	13212215	31324211	14212142
634	23212223	23143112	15121241
635	33212231	22234112	14212241
636	13212314	23143211	13311125
637	14121413	21325112	23311133
638	24121421	22234211	33311141
639	13212413	21325211	13311224
640	23212421	13144112	23311232
641	14121611	12235112	13311323
642	14122124	13144211	23311331
643	24122132	11326112	13311422
644	13213124	12235211	13311521
645	14122223	11326211	14221133
646	24122231	61331111	24221141
647	13213223	11331152	13312133
648	23213231	11331251	14221232
649	13213322	52241111	13312232
650	14122421	51332111	14221331
651	14123132	43151111	13312331
652	13214132	42242111	15131141
653	14123231	41333111	14222141
654	13214231	33152111	13313141
655	32311115	32243111	12411116
656	42311123	31334111	22411124
657	52311131	23153111	32411132
658	32311214	22244111	12411215
659	42311222	21335111	22411223
660	32311313	13154111	32411231
661	42311321	12245111	12411314
662	32311412	11336111	22411322
663	32311511	11341151	12411413

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
664	23221115	44111114	22411421
665	33221123	54111122	12411512
666	22312115	44111213	12411611
667	23221214	54111221	13321124
668	33221222	44111312	23321132
669	22312214	44111411	12412124
670	32312222	34112114	13321223
671	33221321	44112122	23321231
672	22312313	34112213	12412223
673	23221412	44112221	22412231
674	22312412	34112312	12412322
675	23221511	34112411	13321421
676	22312511	24113114	12412421
677	14131115	34113122	14231132
678	24131123	24113213	13322132
679	13222115	34113221	14231231
680	14131214	24113312	12413132
681	33222131	24113411	13322231
682	12313115	14114114	12413231
683	13222214	24114122	21511115
684	23222222	14114213	31511123
685	24131321	24114221	41511131
686	12313214	14114312	21511214
687	22313222	14114411	31511222
688	14131412	14115122	21511313
689	12313313	14115221	31511321
690	13222412	53211113	21511412
691	14131511	63211121	21511511
692	13222511	13211162	12421115
693	14132123	53211212	22421123
694	24132131	13211261	32421131
695	13223123	53211311	11512115
696	14132222	44121113	12421214
697	12314123	54121121	22421222
698	13223222	43212113	11512214
699	14132321	44121212	21512222
700	12314222	43212212	22421321
701	13223321	44121311	11512313
702	14133131	43212311	12421412
703	13224131	34122113	11512412
704	12315131	44122121	12421511
705	41411114	33213113	11512511

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
706	51411122	34122212	13331123
707	41411213	33213212	23331131
708	51411221	34122311	12422123
709	41411312	33213311	13331222
710	41411411	24123113	11513123
711	32321114	34123121	12422222
712	42321122	23214113	13331321
713	31412114	24123212	11513222
714	41412122	23214212	12422321
715	42321221	24123311	11513321
716	31412213	23214311	14241131
717	41412221	14124113	13332131
718	31412312	24124121	12423131
719	32321411	13215113	11514131
720	31412411	14124212	21521114
721	23231114	13215212	31521122
722	33231122	14124311	21521213
723	22322114	13215311	31521221
724	23231213	14125121	21521312
725	33231221	13216121	21521411
726	21413114	62311112	12431114
727	22322213	12311153	22431122
728	32322221	22311161	11522114
729	21413213	62311211	12431213
730	31413221	12311252	22431221
731	23231411	12311351	11522213
732	21413312	53221112	21522221
733	22322411	13221161	11522312
734	21413411	52312112	12431411
735	14141114	53221211	11522411
736	24141122	12312161	13341122
737	13232114	52312211	12432122
738	14141213	44131112	13341221
739	24141221	43222112	11523122
740	12323114	44131211	12432221
741	13232213	42313112	11523221
742	23232221	43222211	21531113
743	11414114	42313211	31531121
744	12323213	34132112	21531212
745	22323221	33223112	21531311
746	14141411	34132211	12441113
747	11414213	32314112	22441121

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
748	21414221	33223211	11532113
749	13232411	32314211	12441212
750	11414312	24133112	11532212
751	14142122	23224112	12441311
752	13233122	24133211	11532311
753	14142221	22315112	13351121
754	12324122	23224211	12442121
755	13233221	22315211	11533121
756	11415122	14134112	21541112
757	12324221	13225112	21541211
758	11415221	14134211	12451112
759	41421113	12316112	11542112
760	51421121	13225211	12451211
761	41421212	12316211	11542211
762	41421311	11411144	16111142
763	32331113	21411152	16111241
764	42331121	11411243	15211133
765	31422113	21411251	25211141
766	41422121	11411342	15211232
767	31422212	11411441	15211331
768	32331311	62321111	16121141
769	31422311	12321152	15212141
770	23241113	61412111	14311124
771	33241121	11412152	24311132
772	22332113	12321251	14311223
773	23241212	11412251	24311231
774	21423113	53231111	14311322
775	22332212	52322111	14311421
776	23241311	51413111	15221132
777	21423212	44141111	14312132
778	22332311	43232111	15221231
779	21423311	42323111	14312231
780	14151113	41414111	13411115
781	24151121	34142111	23411123
782	13242113	33233111	33411131
783	23242121	32324111	13411214
784	12333113	31415111	23411222
785	13242212	24143111	13411313
786	14151311	23234111	23411321
787	11424113	22325111	13411412
788	12333212	21416111	13411511
789	13242311	14144111	14321123

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
790	11424212	13235111	24321131
791	12333311	12326111	13412123
792	11424311	11421143	23412131
793	13243121	21421151	13412222
794	11425121	11421242	14321321
795	41431211	11421341	13412321
796	31432112	12331151	15231131
797	31432211	11422151	14322131
798	22342112	11431142	13413131
799	21433112	11431241	22511114
800	21433211	11441141	32511122
801	13252112	45111113	22511213
802	12343112	45111212	32511221
803	11434112	45111311	22511312
804	11434211	35112113	22511411
805	15111116	45112121	13421114
806	15111215	35112212	23421122
807	25111223	35112311	12512114
808	15111314	25113113	22512122
809	15111413	35113121	23421221
810	15111512	25113212	12512213
811	15112124	25113311	13421312
812	15112223	15114113	12512312
813	15112322	25114121	13421411
814	15112421	15114212	12512411
815	15113132	15114311	14331122
816	15113231	15115121	13422122
817	24211115	54211112	14331221
818	24211214	14211161	12513122
819	34211222	54211211	13422221
820	24211313	45121112	12513221
821	34211321	44212112	31611113
822	24211412	45121211	41611121
823	24211511	44212211	31611212
824	15121115	35122112	31611311
825	25121123	34213112	22521113
826	14212115	35122211	32521121
827	24212123	34213211	21612113
828	25121222	25123112	22521212
829	14212214	24214112	21612212
830	24212222	25123211	22521311
831	14212313	24214211	21612311

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
832	24212321	15124112	13431113
833	14212412	14215112	23431121
834	15121511	15124211	12522113
835	14212511	14215211	13431212
836	15122123	63311111	11613113
837	25122131	13311152	12522212
838	14213123	13311251	13431311
839	24213131	54221111	11613212
840	14213222	53312111	12522311
841	15122321	45131111	11613311
842	14213321	44222111	14341121
843	15123131	43313111	13432121
844	14214131	35132111	12523121
845	33311114	34223111	11614121
846	33311213	33314111	31621112
847	33311312	25133111	31621211
848	33311411	24224111	22531112
849	24221114	23315111	21622112
850	23312114	15134111	22531211
851	33312122	14225111	21622211
852	34221221	13316111	13441112
853	23312213	12411143	12532112
854	33312221	22411151	13441211
855	23312312	12411242	11623112
856	24221411	12411341	12532211
857	23312411	13321151	11623211
858	15131114	12412151	31631111
859	14222114	11511134	22541111
860	15131213	21511142	21632111
861	25131221	11511233	13451111
862	13313114	21511241	12542111
863	14222213	11511332	11633111
864	15131312	11511431	16211132
865	13313213	12421142	16211231
866	14222312	11512142	15311123
867	15131411	12421241	25311131
868	13313312	11512241	15311222
869	14222411	11521133	15311321
870	15132122	21521141	16221131
871	14223122	11521232	15312131
872	15132221	11521331	14411114
873	13314122	12431141	24411122

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
874	14223221	11522141	14411213
875	13314221	11531132	24411221
876	42411113	11531231	14411312
877	42411212	11541131	14411411
878	42411311	36112112	15321122
879	33321113	36112211	14412122
880	32412113	26113112	15321221
881	42412121	26113211	14412221
882	32412212	16114112	23511113
883	33321311	16114211	33511121
884	32412311	45212111	23511212
885	24231113	36122111	23511311
886	34231121	35213111	14421113
887	23322113	26123111	24421121
888	33322121	25214111	13512113
889	22413113	16124111	23512121
890	23322212	15215111	13512212
891	24231311	14311151	14421311
892	22413212	13411142	13512311
893	23322311	13411241	15331121
894	22413311	12511133	14422121
895	15141113	22511141	13513121
896	25141121	12511232	32611112
897	14232113	12511331	32611211
898	24232121	13421141	23521112
899	13323113	12512141	22612112
900	14232212	11611124	23521211
901	15141311	21611132	22612211
902	12414113	11611223	14431112
903	13323212	21611231	13522112
904	14232311	11611322	14431211
905	12414212	11611421	12613112
906	13323311	12521132	13522211
907	15142121	11612132	12613211
908	14233121	12521231	32621111
909	13324121	11612231	23531111
910	12415121	11621123	22622111
911	51511112	21621131	14441111
912	51511211	11621222	13532111
913	42421112	11621321	12623111
914	41512112	12531131	16311122
915	42421211	11622131	16311221

Codeword	Bar-space sequence		
	Cluster 0 BSBSBSBS	Cluster 3 BSBSBSBS	Cluster 6 BSBSBSBS
916	41512211	11631122	15411113
917	33331112	11631221	25411121
918	32422112	14411141	15411212
919	33331211	13511132	15411311
920	31513112	13511231	16321121
921	32422211	12611123	15412121
922	31513211	22611131	24511112
923	24241112	12611222	24511211
924	23332112	12611321	15421112
925	24241211	13521131	14512112
926	22423112	12612131	15421211
927	23332211	12621122	14512211
928	21514112	12621221	33611111

Annex B
(normative)

The default character set for Byte Compaction mode

B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C
0	NUL	32	space	64	@	96	`	128		160	NBSP	192	À	224	à
1	SOH	33	!	65	A	97	a	129		161	¡	193	Á	225	á
2	STX	34	“	66	B	98	b	130		162	¢	194	Â	226	â
3	ETX	35	#	67	C	99	c	131		163	£	195	Ã	227	ã
4	EOT	36	$	68	D	100	d	132		164	¤	196	Ä	228	ä
5	ENQ	37	%	69	E	101	e	133		165	¥	197	Å	229	å
6	ACK	38	&	70	F	102	f	134		166	¦	198	Æ	230	æ
7	BEL	39	‘	71	G	103	g	135		167	§	199	Ç	231	ç
8	BS	40	(	72	H	104	h	136		168	¨	200	È	232	è
9	HT	41	)	73	I	105	I	137		169	©	201	É	233	é
10	LF	42	*	74	J	106	j	138		170	ª	202	Ê	234	ê
11	VT	43	+	75	K	107	k	139		171	«	203	Ë	235	ë
12	FF	44	,	76	L	108	l	140		172	¬	204	Ì	236	ì
13	CR	45	-	77	M	109	m	141		173	SHY	205	Í	237	í
14	SO	46	.	78	N	110	n	142		174	®	206	Î	238	î
15	SI	47	/	79	O	111	o	143		175	¯	207	Ï	239	ï
16	DLE	48	0	80	P	112	p	144		176	°	208	Ð	240	ð
17	DC1	49	1	81	Q	113	q	145		177	±	209	Ñ	241	ñ
18	DC2	50	2	82	R	114	r	146		178	²	210	Ò	242	ò
19	DC3	51	3	83	S	115	s	147		179	³	211	Ó	243	ó
20	DC4	52	4	84	T	116	t	148		180	´	212	Ô	244	ô
21	NAK	53	5	85	U	117	u	149		181	µ	213	Õ	245	õ
22	SYN	54	6	86	V	118	v	150		182	¶	214	Ö	246	ö
23	ETB	55	7	87	W	119	w	151		183	·	215	×	247	÷
24	CAN	56	8	88	X	120	x	152		184	¸	216	Ø	248	ø
25	EM	57	9	89	Y	121	y	153		185	¹	217	Ù	249	ù
26	SUB	58	:	90	Z	122	z	154		186	º	218	Ú	250	ú
27	ESC	59	;	91	[	123	{	155		187	»	219	Û	251	û
28	IS4/FS	60	<	92	\	124	|	156		188	¼	220	Ü	252	ü
29	IS3/GS	61	=	93	]	125	}	157		189	½	221	Ý	253	ý
30	IS2/RS	62	>	94	^	126	~	158		190	¾	222	Þ	254	þ
31	IS1/US	63	?	95	_	127	DEL	159		191	¿	223	ß	255	ÿ

NOTE This table corresponds to the character set defined in ISO/IEC 8859-1, with the addition of the control characters (byte values 00 – 31) defined in ISO/IEC 646, International Reference Version.

Annex C
(normative)

Byte Compaction mode encoding algorithm

This conversion is used in Byte Compaction mode. It converts six data bytes to five PDF417 data codewords. The conversion equation is:

$$b_5 \times 256^5 + b_4 \times 256^4 + b_3 \times 256^3 + b_2 \times 256^2 + b_1 \times 256^1 + b_0 \times 256^0$$

$$= d_4 \times 900^4 + d_3 \times 900^3 + d_2 \times 900^2 + d_1 \times 900^1 + d_0 \times 900^0$$

where

b is the data byte value as a decimal (0 to 255);

d is the data codeword.

The following algorithm may be used for a base 256 to base 900 conversion.

a) Designate t = temporary variable

b) Calculate $t = b_5 \times 256^5 + b_4 \times 256^4 + b_3 \times 256^3 + b_2 \times 256^2 + b_1 \times 256^1 + b_0 \times 256^0$

c) Calculate each codeword as follows:

For each data codeword $d_i = d_o \ldots. d_4$

BEGIN

d_i = t mod 900

t = t div 900

END

EXAMPLE

Encode the Byte Compaction characters $b_5 \ldots. b_0$ {231, 101, 11, 97, 205, 2}

Calculate the sum t using the decimal values of the six Byte Compaction characters:

$t = 231 \times 256^5 + 101 \times 256^4 + 11 \times 256^3 + 97 \times 256^2 + 205 \times 256^1$

$+ 2 \times 256^0$

$= 254\ 421\ 168\ 672\ 002$

Calculate codeword 0

d_0 = 254 421 168 672 002 mod 900 = 302

t = 254 421 168 672 002 div 900 = 282 690 187 413

Calculate codeword 1

d_1 = 282 690 187 413 mod 900 = 213

t = 282 690 187 413 div 900 = 314 100 208

Calculate codeword 2

d_2 = 314 100 208 mod 900 = 208

t = 314 100 208 div 900 = 349 000

Calculate codeword 3

d_3 = 349 000 mod 900 = 700

t = 349 000 div 900 = 387

Calculate codeword 4

d_4 = 387 mod 900 = 387

t = 387 div 900 = 0

The codeword sequence d_4 ... d_0 is 387, 700, 208, 213, 302

Annex D
(normative)

Numeric Compaction mode encoding algorithm

This conversion is used in Numeric Compaction mode. It converts groups of up to 44 consecutive numeric digits to 15 or fewer PDF417 data codewords.

The following algorithm may be used for a base 10 to base 900 conversion.

a) Designate t = temporary value.

b) Set the initial value of t to be the group of up to 44 consecutive numeric digits, preceded by the digit 1.

c) Calculate each codeword as follows:

For each data codeword $d_i = d_0 .... d_{n-1}$

BEGIN

d_i	=	t mod 900
t	=	t div 900
If t	=	0, then stop encoding

END

EXAMPLE

Encode the fifteen digit numeric string 000213298174000

Prefix the numeric string with a 1 and set the initial value of

t = 1 000 213 298 174 000

Calculate codeword 0

d_0	= 1 000 213 298 174 000 mod 900	= 200
t	= 1 000 213 298 174 000 div 900	= 1 111 348 109 082

Calculate codeword 1

d_1	= 1 111 348 109 082 mod 900	= 282
t	= 1 111 348 109 082 div 900	= 1 234 831 232

Calculate codeword 2

d_2	= 1 234 831 232 mod 900	= 632
t	= 1 234 831 232 div 900	1 372 034

Calculate codeword 3

d_3	= 1 372 034 mod 900	= 434
t	= 1 372 034 div 900	= 1 524

Calculate codeword 4

d_4	= 1 524 mod 900	= 624
t	= 1 524 div 900	= 1

Calculate codeword 5

d_5	= 1 mod 900	= 1
t	= 1 div 900	= 0

The codeword sequence d_5 ... d_0 is 1, 624, 434, 632, 282, 200

Annex E
(normative)

User selection of error correction level

E.1 Recommended minimum error correction level

The minimum level of error correction level should be as defined in Table E.1.

Table E.1 — Recommended Error Correction Level

Number of Data Codewords	Minimum Error Correction Level
1 to 40	2
41 to 160	3
161 to 320	4
321 to 863	5

As a guide for estimating the number of data codewords from data content in order to use Table E.1, use 1,8 text characters per data codeword in Text Compaction mode, 2,9 digits per data codeword in Numeric Compaction mode and 1,2 bytes per data codeword in Byte Compaction mode.

Higher levels of error correction should be used where significant symbol damage or degradation is anticipated. Lower than recommended error correction levels may be used in closed system applications.

E.2 Other user consideration of the error correction level

The objective in an application standard should be to make use of the features of error correction without sacrificing the data content capacity.

The following factors should be taken into account by the user in selecting an error correction level.

a) The recommended error correction level (see Table E.1) should be followed.

b) Since the maximum number of data codewords per symbol is fixed at 925, large numbers of data codewords limit the maximum level of error correction that can be implemented. More than 415 data codewords precludes Error Correction Level 8. More than 671 data codewords precludes Levels 7 and 8. More than 799 data codewords precludes Levels 6, 7 and 8. More than 863 data codewords precludes Level 5 and therefore is not recommended.

c) Where PDF417 symbols are likely to have missing or totally obliterated codewords, the Error Correction Level may be increased up to Error Correction level 8, or up to a level where the number of error correction codewords fills the maximum sized matrix appropriate for the application.

d) It is preferable to maintain symbol quality rather than to compensate for poor print quality by increasing the error correction level. Instead of adopting a higher error correction level, it may be better to specify a larger X-dimension or particular substrates and materials which can maintain the print quality of the PDF417 symbol.

Annex F
(normative)

Tables of coefficients for calculating PDF417 error correction codewords

Table F.1 — Coefficient table for error correction level 0

j	0	1
α_j	27	917

Table F.2 — Coefficient table for error correction level 1

j	0	1	2	3
α_j	522	568	723	809

Table F.3 — Coefficient table for error correction level 2

j	0	1	2	3	4	5	6	7
α_j	237	308	436	284	646	653	428	379

Table F.4 — Coefficient table for error correction level 3

j	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
α_j	274	562	232	755	599	524	801	132	295	116	442	428	295	42	176	65

Table F.5 — Coefficient table for error correction level 4

j	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
α_j	361	575	922	525	176	586	640	321	536	742	677	742	687	284	193	517
j	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
α_j	273	494	263	147	593	800	571	320	803	133	231	390	685	330	63	410

Table F.6 — Coefficient table for error correction level 5

j	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
α_j	539	422	6	93	862	771	453	106	610	287	107	505	733	877	381	612
j	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
α_j	723	476	462	172	430	609	858	822	543	376	511	400	672	762	283	184
j	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
α_j	440	35	519	31	460	594	225	535	517	352	605	158	651	201	488	502
j	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
α_j	648	733	717	83	404	97	280	771	840	629	4	381	843	623	264	543

Table F.7 — Coefficient table for error correction level 6

j	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
α_j	521	310	864	547	858	580	296	379	53	779	897	444	400	925	749	415
j	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
α_j	822	93	217	208	928	244	583	620	246	148	447	631	292	908	490	704
j	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
α_j	516	258	457	907	594	723	674	292	272	96	684	432	686	606	860	569
j	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
α_j	193	219	129	186	236	287	192	775	278	173	40	379	712	463	646	776
j	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
α_j	171	491	297	763	156	732	95	270	447	90	507	48	228	821	808	898
j	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
α_j	784	663	627	378	382	262	380	602	754	336	89	614	87	432	670	616
j	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
α_j	157	374	242	726	600	269	375	898	845	454	354	130	814	587	804	34
j	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
α_j	211	330	539	297	827	865	37	517	834	315	550	86	801	4	108	539

Table F.8 — Coefficient table for error correction level 7

j	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
α_j	524	894	75	766	882	857	74	204	82	586	708	250	905	786	138	720
j	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
α_j	858	194	311	913	275	190	375	850	438	733	194	280	201	280	828	757
j	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
α_j	710	814	919	89	68	569	11	204	796	605	540	913	801	700	799	137
j	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
α_j	439	418	592	668	353	859	370	694	325	240	216	257	284	549	209	884
j	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
α_j	315	70	329	793	490	274	877	162	749	812	684	461	334	376	849	521
j	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
α_j	307	291	803	712	19	358	399	908	103	511	51	8	517	225	289	470
j	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
α_j	637	731	66	255	917	269	463	830	730	433	848	585	136	538	906	90
j	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
α_j	2	290	743	199	655	903	329	49	802	580	355	588	188	462	10	134
j	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
α_j	628	320	479	130	739	71	263	318	374	601	192	605	142	673	687	234
j	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
α_j	722	384	177	752	607	640	455	193	689	707	805	641	48	60	732	621
j	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
α_j	895	544	261	852	655	309	697	755	756	60	231	773	434	421	726	528
j	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
α_j	503	118	49	795	32	144	500	238	836	394	280	566	319	9	647	550

Table F.8 *(continued)*

j	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
α_j	73	914	342	126	32	681	331	792	620	60	609	441	180	791	893	754
j	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
α_j	605	383	228	749	760	213	54	297	134	54	834	299	922	191	910	532
j	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
α_j	609	829	189	20	167	29	872	449	83	402	41	656	505	579	481	173
j	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
α_j	404	251	688	95	497	555	642	543	307	159	924	558	648	55	497	10

Table F.9 — Coefficient table for error correction level 8

j	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
α_j	352	77	373	504	35	599	428	207	409	574	118	498	285	380	350	492
j	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
α_j	197	265	920	155	914	299	229	643	294	871	306	88	87	193	352	781
j	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
α_j	846	75	327	520	435	543	203	666	249	346	781	621	640	268	794	534
j	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
α_j	539	781	408	390	644	102	476	499	290	632	545	37	858	916	552	41
j	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
α_j	542	289	122	272	383	800	485	98	752	472	761	107	784	860	658	741
j	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
α_j	290	204	681	407	855	85	99	62	482	180	20	297	451	593	913	142
j	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
α_j	808	684	287	536	561	76	653	899	729	567	744	390	513	192	516	258
j	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
α_j	240	518	794	395	768	848	51	610	384	168	190	826	328	596	786	303
j	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
α_j	570	381	415	641	156	237	151	429	531	207	676	710	89	168	304	402
j	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
α_j	40	708	575	162	864	229	65	861	841	512	164	477	221	92	358	785
j	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
α_j	288	357	850	836	827	736	707	94	8	494	114	521	2	499	851	543
j	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
α_j	152	729	771	95	248	361	578	323	856	797	289	51	684	466	533	820
j	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
α_j	669	45	902	452	167	342	244	173	35	463	651	51	699	591	452	578
j	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
α_j	37	124	298	332	552	43	427	119	662	777	475	850	764	364	578	911
j	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
α_j	283	711	472	420	245	288	594	394	511	327	589	777	699	688	43	408
j	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
α_j	842	383	721	521	560	644	714	559	62	145	873	663	713	159	672	729

Table F.9 *(continued)*

j	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271
α_j	624	59	193	417	158	209	563	564	343	693	109	608	563	365	181	772
j	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287
α_j	677	310	248	353	708	410	579	870	617	841	632	860	289	536	35	777
j	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303
α_j	618	586	424	833	77	597	346	269	757	632	695	751	331	247	184	45
j	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319
α_j	787	680	18	66	407	369	54	492	228	613	830	922	437	519	644	905
j	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335
α_j	789	420	305	441	207	300	892	827	141	537	381	662	513	56	252	341
j	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351
α_j	242	797	838	837	720	224	307	631	61	87	560	310	756	665	397	808
j	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367
α_j	851	309	473	795	378	31	647	915	459	806	590	731	425	216	548	249
j	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383
α_j	321	881	699	535	673	782	210	815	905	303	843	922	281	73	469	791
j	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399
α_j	660	162	498	308	155	422	907	817	187	62	16	425	535	336	286	437
j	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415
α_j	375	273	610	296	183	923	116	667	751	353	62	366	691	379	687	842
j	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431
α_j	37	357	720	742	330	5	39	923	311	424	242	749	321	54	669	316
j	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447
α_j	342	299	534	105	667	488	640	672	576	540	316	486	721	610	46	656
j	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463
α_j	447	171	616	464	190	531	297	321	762	752	533	175	134	14	381	433
j	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479
α_j	717	45	111	20	596	284	736	138	646	411	877	669	141	919	45	780
j	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495
α_j	407	164	332	899	165	726	600	325	498	655	357	752	768	223	849	647
j	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511
α_j	63	310	863	251	366	304	282	738	675	410	389	244	31	121	303	263

Annex G
(normative)

Compact PDF417

G.1 Description

Compact PDF417 may be used where space considerations are a primary concern and symbol damage is unlikely. In an environment where label damage is unlikely (e.g. an office), the right row indicators may be omitted and the stop pattern may be reduced to one module width bar, as indicated in Figure G.1. This procedure reduces the non-data overhead from 4 codewords per row to 2 codewords per row, with some trade-off in decode performance and robustness, or the ability to withstand noise, damage, degradation, dust etc.

This overhead reduction version is called Compact PDF417, which is fully decoder compatible with standard PDF417.

A Compact PDF417 symbol with fewer than 6 rows encodes the number of columns in only one place, which is not error corrected, and is therefore extremely vulnerable to poor print quality or damage.

NOTE In the original AIM USA (1994) and AIM Europe (1994) PDF417 specifications, the term Truncated PDF417 has been used in a technically synonymous manner. The name Compact PDF417 is preferred to avoid confusion with the more general use of the term 'truncated'.

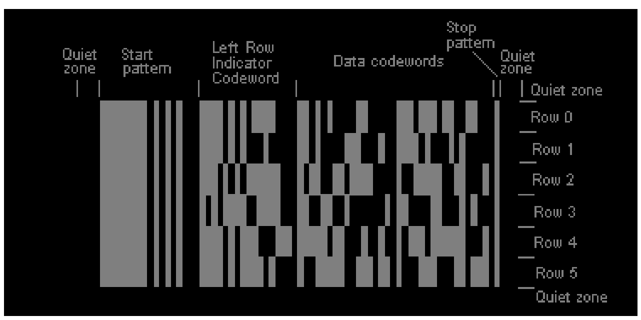


Figure G.1 — Compact PDF417

G.2 Print quality

Although the standard print quality method specified in 5.14.4 is applied to Compact PDF417, the absence of a Stop Pattern (other than the single module bar) requires two exceptions to be made.

The analysis of scan reflectance profiles for the Start and Stop Patterns applies only to the Start Pattern.

For the assessment of Codeword Yield, the requirement that a qualifying scan of the top or bottom row of the symbol (which ISO/IEC 15415 includes the decoding of both Start and Stop Patterns) cannot be applied; instead, as for other rows, the Start Pattern and at least one additional codeword must have been decoded.

Annex H
(normative)

Macro PDF417

H.1 Macro PDF417 overview

Macro PDF417 provides a standard mechanism for creating a distributed representation of files too large to be represented by a single PDF417 symbol. Macro PDF417 symbols differ from ordinary PDF417 symbols in that they contain additional control information in a Macro PDF417 Control Block.

Using Macro PDF417, large files are split into several file segments and encoded into individual symbols. The Control Block defines the file ID, the concatenation sequence and optionally other information about the file. The Macro PDF417 decoder uses the Control Block's information to reconstruct the file correctly, independent of symbol scanning order.

H.2 Macro PDF417 syntax

Each Macro PDF417 symbol shall encode a Macro PDF417 Control Block containing control information. The Control Block begins with the Macro marker codeword (928). The Control Block follows the data block with which it is associated, and the number of codewords in the control block is counted as data and incorporated in the value of the Symbol Length Descriptor. The beginning of the error correction codewords identifies the end of the Control Block.

NOTE A symbol containing no user data, other than a Macro PDF417 Control Block, is a valid symbol.

The Control Block shall contain at least the two mandatory fields: a segment index and file ID. It also may contain a number of optional fields, as described in H.2.3.

Figure H.1 illustrates the position of the Control Block in a Macro PDF417 symbol.

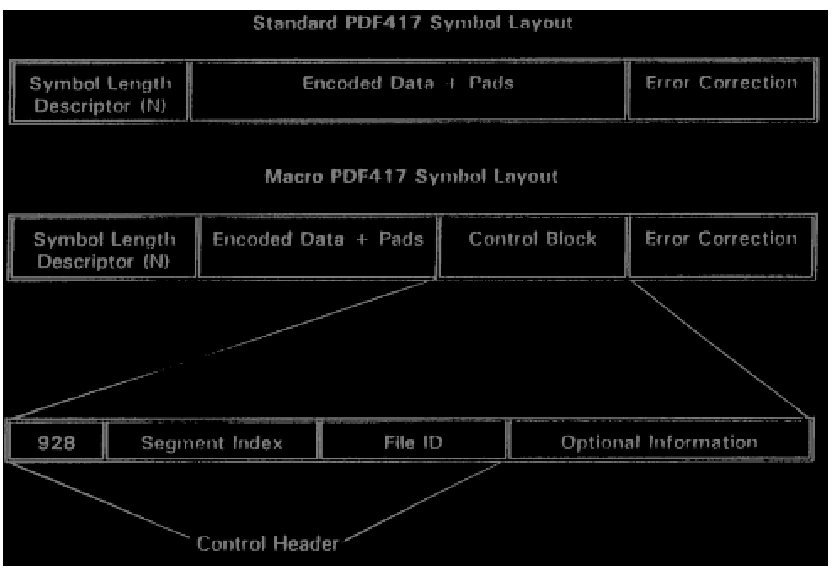


Figure H.1 — PDF417 Symbol Layouts

H.2.1 The segment index

In Macro PDF417, each symbol represents a segment of the whole file. To reconstruct the whole file, the segments need to be placed in the correct order. Control information in the Control Block facilitates this reassembly process. For a file divided into a set of j Macro PDF417 symbols, the segment index field in each symbol's Control Block contains a value between 0 and *j* - 1, corresponding to the relative position of that symbol's content within the distributed representation.

The segment index field is two codewords in length and is encoded using Numeric Compaction mode as defined in 5.4.4. The segment index value shall be padded with leading zeros to five digits before Numeric Compaction shall be applied, and the switch to Numeric Compaction shall not require an explicit mode latch (codeword 902). The largest allowed value in the segment index field is 99 998. Thus, up to 99 999 Macro PDF417 symbols may comprise the distributed representation of a data file.

NOTE This translates to a capacity of nearly 110 million bytes of data in Byte Compaction mode, or 184 million characters in Text Compaction mode, or nearly 300 million characters in Numeric Compaction mode.

H.2.2 File ID field

For each related Macro PDF417 symbol, the file ID field contains the same value. This ensures that all re-assembled symbol data belongs to the same distributed file representation. The file ID is a variable length field which begins with the first codeword following the segment index and extends to the start of the optional fields (if present) or to the end of the Control Block (if not).

Each codeword in the file ID can have a value between 0 and 899, effectively making the file ID a series of base 900 numbers. Each codeword of the series is transmitted as the 3-digit ASCII representation of its decimal value.

NOTE The effectiveness of the file identification scheme is influenced by both the length of the file ID field and the suitability of the algorithm used to generate its value.

H.2.3 Optional fields

Optional fields may follow the file ID. Each optional field begins with a specific tag sequence and extends until the start of the next optional field (if present) or the end of the Control Block (if not). The tag sequence consists of codeword 923 followed by a single codeword field designator. In each optional field, data following the tag sequence has a field-specific interpretation. Empty optional fields shall not be used. Table H.1 shows the correspondence between currently defined field designators and optional field contents. Each optional field begins with an implied reset to the compaction mode shown in the table and with an implied reset to ECI 000002 (or GLI 0 for encoders complying with earlier PDF417 standards). ECI escape sequences and mode latches and shifts may be used, but only in the optional fields initially in Text Compaction mode.

These fields shall always represent global file attributes and so need not be present in the Control Block of more than one Macro PDF417 symbol within the distributed file representation, with the exception of the segment count field, as described below. The segment which contains these fields is defined by the specific encoder implementation. If a particular field is to appear in more than one segment, it shall appear identically in every segment. There is no required order for the optional fields.

Table H.1 — Macro PDF417 Optional Field Designators

Field Designator	Byte Value Transmitted	Contents	Initial Compaction Mode	Fixed Compaction Mode[a]	Total Number of Codewords[b]
0	48	File Name	Text Compaction	N	Variable
1	49	Segment Count	Numeric Compaction	Y	4
2	50	Time Stamp	Numeric Compaction	Y	6
3	51	Sender	Text Compaction	N	Variable
4	52	Addressee	Text Compaction	N	Variable
5	53	File Size	Numeric Compaction	Y	Variable
6	54	Checksum	Numeric Compaction	Y	4

[a] A 'Y' in the 'Fixed Compaction Mode' column means that no ECIs and no compaction mode latches and shifts are allowed in that field.

[b] The totals shown in the last column include the two-codeword tag sequence.

As shown in Table H.1, all optional fields use standard PDF417 high-level encoding. At the beginning of each field, the default mode in effect shall be defined by Table H.1, regardless of mode shifts and latches earlier in the symbol.

Specific construction of optional fields shall be as follows.

— The segment count field (identifying the total number of Macro PDF417 symbols in the distributed file) can contain values from 1 to 99 999 and shall be encoded as two codewords. If the optional segment count field is used, that field shall appear in every segment.

— The time stamp field shall be interpreted in Numeric Compaction mode. It indicates the time stamp on the source file expressed as the elapsed time in seconds since 1970:01:01:00:00:00 GMT (i.e. 00:00:00 GMT on 1 January 1970). Using this format, four codewords can encode any date over the next 200 centuries.

— The file size field contains the size in bytes of the entire source file.

— The checksum field contains the value of the 16-bit (2 bytes) CRC checksum using the CCITT-16 polynomial $x^{16} + x^{12} + x^{5} + 1$ computed over the entire source file.

The file size and checksum shall be calculated from the original source file, prior to the addition of any ECI escape sequences for Extended Channel Interpretation encoding. This implies that, if the receiver is to verify the checksum after reception, the original source file must be reconstructed verbatim. This requires, for the purposes of this optional checksum verification only, that no user-selectable or optional transformations of the byte stream be performed, even if these would normally be done in ECI decode processing.

If the CRC is used, the calculation may be performed either before the data is sent to the printer or in the printer, based on the capabilities of the printer.

Field designator values greater than 6 are not currently defined. However, PDF417 decoding equipment shall decode and transmit any optional fields encountered with a field designator of 7 to 9 (byte 55 to 57) or A to Z (byte 65 to 90) by treating the field's data as being initially in Text Compaction mode and being variable length.

H.2.4 Macro PDF417 terminator

The Control Block in the symbol representing the last segment of a Macro PDF417 file contains a special marker, consisting of the codeword 922 at the end of the Control Block. The Control Block for every other symbol shall end after any optional fields with no special terminator.

H.3 High level encoding considerations

While Macro PDF417 provides a mechanism for logically associating a set of symbols, it is important to realise that, with respect to PDF417 high-level encoding, each symbol shall remain a distinct entity. Thus, the scope of a mode switch shall be confined to the symbol in which it occurs. Each symbol shall implicitly begin in the Alpha sub-mode of the Text Compaction mode.

The two mandatory fields are encoded as follows: a) the segment index is encoded in Numeric Compaction mode; b) the file ID is encoded as a sequence of base 900 numbers.

In the context of a Control Block optional field, the compaction modes indicated in Table H.1 shall supersede the mode currently set by the mode identifier codewords within the data codeword region of the symbol. The scope of the current ECI, however, skips over the Macro Control Block to the start of the next Macro PDF417 symbol. Each Macro Control Block field begins with an implied reset to ECI 000002 (or GLI 0 for encoders complying with the earlier PDF417 standards). It shall also be possible to set a different ECI within an optional Text Compaction mode Macro Control Block field, for example, to represent properly a Greek addressee's name. The ECI escape sequence may be placed in any permitted position (see 5.5.3) after the tag codeword (923).

H.4 Encodation example

To illustrate the encodation of a Macro Control Block, the following example is used.

A Macro PDF417 series encodes a total of 4 567 bytes of user defined data in four PDF417 symbols (or file segments). Other 'header' data to be encoded are

— File ID = $17_{\text{base 900}}$ $53_{\text{base 900}}$,

— Segment count to be used,

— Sender: CEN BE, and

— Addressee: ISO CH.

NOTE The segment count, sender and addressee are three optional fields selected by the user.

On the assumption that the encoder places optional fields in the first symbol, the encodation of the Macro Control Block would be as follows for that symbol.

… [last data codeword] $[928]_A$ [111] $[100]_B$ [017] $[053]_C$ [923] $[001]_D$

[111] $[104]_E$ [923] $[003]_F$ [064] [416] $[034]_G$ [923] $[004]_H$ [258] [446] $[067]_I$

[first error correcting codeword]…

The last symbol of four would have the following Macro Control Block:

[last data codeword] $[928]_A$ [111] $[103]_B$ [017] $[053]_C$

923] $[001]_D$ [111] $[104]_E$ $[922]_J$ [first error correcting codeword]

where

A is the Macro Marker Codeword;

B is the File Segment ID.

File segments are numbered from 0 to j - 1, and are encoded using Numeric Compaction

1st Segment = 00000 = codewords 111, 100

4th Segment = 00003 = codewords 111, 103

C = File ID to base 900

D = Tag for segment count field

E = Segment count

F = Tag for sender field

G = Sender field encoding CEN BE

H = Tag for addressee field

I = Addressee field encoding ISO CH

J = Macro PDF417 Terminator

H.5 Macro PDF417 and the Extended Channel Interpretation protocol

The symbology-independent Extended Channel Interpretation (ECI) protocol was developed after PDF417 was specified as a symbology. PDF417 supported its own Global Label Identifier (GLI) system, the precursor and basis of the ECI protocol, from the first publication of the symbology specification in 1994. Therefore, previous 'GLI' implementations have to be taken into account. There are two different conditions which need to be taken into account:

— GLI 0 and 1 which were the only interpretations specified in the original PDF417 specifications. These are equivalent to ECI 000000 and ECI 000001. The precise rules for Macro PDF417 are defined in H.5.1;

— all other ECI assignments, whose usage with Macro PDF417 is defined in H.5.2.

H.5.1 Macro PDF417 with ECI 000000 and 000001 (GLI 0 and 1)

As GLIs were intrinsically part of the original PDF417 specification, it is logical to have a GLI encoder and Macro PDF417 encoder combined in one unit. The original PDF417 symbology specification called for an implied 'return-to-GLI 0' logic at the beginning of the second and subsequent Macro PDF417 symbols, thus every symbol is expected to start at the default interpretation. For GLI 0 and 1 (equivalent to ECI 000000 and ECI 000001), this has no inherent effect on the encodation. However, for some complex ECIs, the return-to-GLI 0 logic is difficult to implement in a symbology-independent manner.

Encoding software compliant with the original specification for Macro PDF417 and GLI 0 and 1 is completely suitable for pre-existing applications. So too are pre-existing applications of user defined GLIs (now called ECIs) because by definition, the domain of the system is constrained.

All ECIs numbered 000002 or higher shall not be defined with the return-to-GLI 0 logic. Therefore, PDF417 symbols shall not mix ECI 000000 and ECI 000001 with any higher numbered ECI (except in closed systems).

H.5.2 Macro PDF417 and other ECIs

An ECI encoder could be symbology independent and create a byte stream as input to a PDF417 symbology encoder. The ECI encoder should behave as if there is a single data stream, irrespective of the size of the file. Thus, an ECI once invoked would persist across segments until another ECI or the end of the encoded data. This is essential if, for example, the ECI assignment represents an encryption scheme, where returning to GLI 0 would not be appropriate.

Macro PDF417 encoders compliant with this International Standard need not encode the prevailing ECI at the beginning of subsequent Macro PDF417 symbols.

NOTE There may need to be some iteration to produce a logical end-of-symbol encodation, for example, Numeric Compaction mode shall not straddle two segments, but two separate Numeric Compaction blocks can be encoded at the end of one symbol and at the beginning of the next. These conditions are related to Macro PDF417 and High Level Encoding (see H.3) and not Macro PDF417 and ECIs.

H.6 Macro PDF417 data transmission

The transmission of Macro PDF417 Control Block information shall be treated in a similar manner to that of interpretative ECIs. The symbology-independent ECI protocol is defined below; the original PDF417 protocol is defined in Annex M. Although the Macro Control Block is encoded at the end of the symbol's data, it is transmitted before the symbol's data when using the ECI protocol.

Three codewords (922, 923 and 928) signal the encodation of a Macro PDF417 Control Block or one of its constituent parts. Decoding is as follows:

a) If the Macro marker codeword (928) begins the sequence:

   1) Codeword 928 is transmitted as the escape sequence 92, 77, 73, which represents '\MI' in the default interpretation.

   2) The next two codewords identify the segment index. These are encoded in Numeric Compaction mode and decode as a 5-digit number in the range 00 000 to 99 998.

   3) The next codewords encode the file ID field, which shall be the same for all related Macro PDF417 symbols. The end point of the file ID field is codeword 922, codeword 923, or the end of the encoded data in the symbol. Each codeword is converted to a 3-digit number in the range 000 to 899 (i.e. the codeword number) and transmitted as three byte values (in the range decimal 48 to 57) following the escape header 92, 77, 70, which represents '\MF' in the default interpretation.

b) If the Macro sequence tag codeword (923) begins the sequence:

   1) Codeword 923 is transmitted as the escape sequence 92, 77, 79, which represents '\MO' in the default interpretation.

   2) The next codeword represents one of the optional field designators in Table H.1 transmitted as a single byte representing the ASCII value of the designator.

   3) The next codewords carry the data content of the optional field designator. The end point of the optional field is codeword 922, codeword 923, or the end of the encoded data in the symbol. The intervening codewords should be converted according to the decode rules of the relevant compaction mode defined in Table H.1. The resultant data may be variable length.

c) If the Macro PDF417 Terminator (codeword 922) is identified, the escape sequence 92, 77, 90, which represents '\MZ' in the default interpretation, shall be transmitted.

d) At the end of the Macro Control Block, as defined by the end of encoded data in the symbol, the escape sequence 92, 77, 89, which represents '\MY' in the default interpretation, shall be transmitted.

NOTE This escape sequence is not explicitly encoded in the symbol.

All the Macro Control Block fields for a symbol (segment) shall be transmitted as a single block starting with \MI... and ending with \MY. The transmission of the Macro Control Block shall precede the transmission of the remainder of the encoded file segment, even though it is encoded at the end of the symbol.

EXAMPLE

The Macro PDF417 Control Block of the first symbol, Segment Index = 0, with a File ID (100, 200, 300) would be encoded in the symbol as the codeword sequence:

[928] [111] [100] [100] [200] [300]

It would be transmitted as:

Data transmission (byte):

92, 77, 73, 48, 48, 48, 48, 48, 92, 77, 70, 49, 48, 48, 50, 48, 48, 51, 48, 48, 92, 77, 89

ASCII interpretation:

\MI00000\MF100200300\MY

As the Macro PDF417 symbols are scanned, the de-packetizing function reconstructs the original message, bearing in mind that the symbols may be scanned out of sequence. If the system is operating in buffered mode, the de-packetizing function is in the decoder; if operating in unbuffered mode, it is in the receiving system.

Decoders should provide a decoder-specific means whereby the processing of a given Macro PDF417 file ID may be aborted, thus allowing the decoder to begin processing a new File ID. This is necessary to prevent a deadlock condition should one or more symbols of a given File ID be missing or undecodable.

H.6.1 Operating in buffered mode

In buffered mode, de-packetizing shall be performed in the decoder/reader. Depending on the equipment configuration, it will either

— send the reconstructed data with no Macro Control Block, or

— send one Macro Control Block (which itself may have been reconstructed to include all optional fields included in any symbols) to precede the entire encoded message. The resulting Macro Control Block shall have its Macro Index field set to 0 and shall include the Macro end-of-file field (in effect, to mark the entire reconstructed message as the first - and only - Macro segment of the pseudo-series).

H.6.2 Operating in unbuffered mode

In unbuffered mode, de-packetizing shall be performed in the receiving system. Each transmitted Macro Control Block shall represent all of the required and optional fields actually encoded in the symbol.

When configured in unbuffered mode, a decoder may optionally be configured not to require successive symbols to be of the same File ID. This procedure would only be appropriate if the decoder is configured to transmit the Macro PDF417 Control Block to the receiving system, and this receiving system is designed to monitor the File ID portion of the Control Block to determine when the entire file has been processed. Symbols with a different File ID or no File ID (e.g. a single symbol not part of a Macro PDF417 set) shall be dealt with as determined by the receiving system.

To facilitate checking that all symbols in a Macro PDF417 set are received in an unbuffered operation, the optional Segment Count field should be used whenever possible as part of the encoded Macro Control Block.

H.6.3 Reset-to-Zero transmissions

Because the original AIM USA (1994) and AIM Europe (1994) PDF417 specifications defined GLI 0 and GLI 1 to have rules slightly different from the rules for ECIs, a reader compliant with this International

Standard must, in two situations, emit extra escape sequences when transmitting symbols containing explicit GLI 1 invocations.

a) The decoder shall transmit either a GLI 0 escape sequence or an ECI 000000 escape sequence (depending upon which transmission protocol it is programmed to use) after transmitting the data of any Macro PDF417 symbol whose data ends in a GLI 1 (ECI 000001) interpretation.

b) The decoder shall transmit a GLI 1 (ECI 000001) at the start of each variable length optional field encoded in Text Compaction mode in the Macro Control Block, if the data preceding that field ends in a GLI 1 (ECI 000001) interpretation.

This requirement applies whether operating in buffered or unbuffered mode, and whether the decoder is programmed to transmit using either the ECI protocol, or the original PDF417 transmission protocol.

Annex I
(normative)

Testing PDF417 symbol quality

As specified in 5.14.4, the quality of PDF417 symbols is evaluated according to the methodology defined in ISO/IEC 15415 for the assessment of multi-row symbologies with cross-row scanning ability.

In summary, PDF417 symbols are graded in respect of the following:

— analysis of the scan reflectance profile, applied to the start and stop patterns only;

— Codeword Yield, applied to the data and error correction codewords only, which measures the efficiency with which linear scans can recover data from the symbol. The Codeword Yield is the number of validly decoded codewords expressed as a percentage of the maximum number of codewords that could have been decoded, i.e. the number of data columns in the symbol multiplied by the number of "qualified" scans (after adjusting for tilt);

— Unused Error Correction, applied to the data and error correction codewords only, which expresses the number of errors and erasures as a function of the error correction capacity of the symbol;

— codeword print quality, applied to the data and error correction codewords only, which enables the Decodability, Defects and Modulation parameters of scan reflectance profiles covering the entire data region of the symbol to be graded; these grades are then modified to allow for the effect of error correction in masking less than perfect attributes of the symbol that influence symbol quality.

The overall symbol grade shall be the lowest of the grade based on analysis of the scan reflectance profile, and the grades based on Codeword Yield, Unused Error Correction and codeword print quality.

Annex J
(normative)

Reference decode algorithm for PDF417

J.1 General

This Annex describes the reference decode algorithm used in the computation of decodability when assessing the symbol quality using the method described in ISO/IEC 15415.

When assessing symbol quality through the use of this reference decode algorithm, a PDF417 symbol shall be decoded, in a series of scan lines running across the symbol that cross at least one start or stop character, but not necessarily row by row. It is possible to decode the symbol if the scan line crosses two or more rows by using the cluster number. The decoding of symbol character bar-space sequences shall be achieved by using 'edge to similar edge' (e) measurements.

The PDF417 symbol shall be decoded in four phases:

a) initialisation - to establish the symbol matrix;

b) line decoding using the reference decode algorithm;

c) filling the matrix;

d) interpretation.

J.2 Initialisation

A sufficient number of line decodes (see J.3) shall be performed at the start of the decode process to establish the symbol structure parameters [number of rows (*r*), number of columns (*c*)], and error correction levels. This information is encoded in the left and right row indicators, adjacent respectively to the start and stop characters.

After the symbol structure parameters have been initialised, a matrix shall be established which reflects the size (rows by columns) of the symbol being decoded. The matrix shall exclude start and stop characters and row indicators.

J.3 Reference decode algorithm for line decoding

A decodable scan line shall contain at least one quiet zone, a start or stop character, one row indicator and one or more symbol characters in the data region. A scan line may cross more than one row. The algorithm contains the following steps to decode the line.

a) Confirm the presence of a quiet zone.

b) For each symbol character bar-space sequence (including start and stop character), calculate the following width measurements as per Figure J.1.

p

e_1, e_2, e_3, e_4, e_5 and e_6

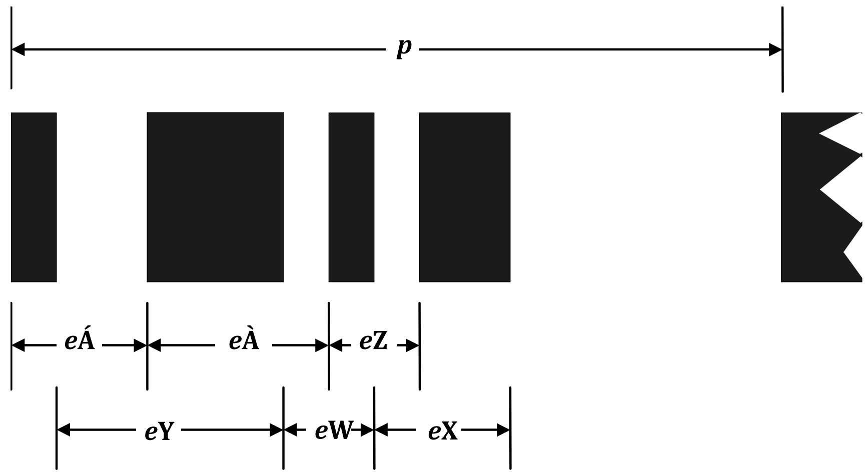


Figure J.1 — Decode measurements

c) Convert measurements e_1, e_2, e_3, e_4, e_5, and e_6 to normalised values E_1, E_2, E_3, E_4, E_5 and E_6 which will represent the integral module width of these measurements. The following method is used for the i th value.

If $1{,}5p/17 \le e_i < 2{,}5p/17$, then $E_i = 2$

If $2{,}5p/17 \le e_i < 3{,}5p/17$, then $E_i = 3$

If $3{,}5p/17 \le e_i < 4{,}5p/17$, then $E_i = 4$

If $4{,}5p/17 \le e_i < 5{,}5p/17$, then $E_i = 5$

If $5{,}5p/17 \le e_i < 6{,}5p/17$, then $E_i = 6$

If $6{,}5p/17 \le e_i < 7{,}5p/17$, then $E_i = 7$

If $7{,}5p/17 \le e_i < 8{,}5p/17$, then $E_i = 8$

If $8{,}5p/17 \le e_i < 9{,}5p/17$, then $E_i = 9$

Otherwise, the symbol character bar-space sequence is in error.

d) After finding a start or stop character, attempt to decode a row indicator, and as many symbol characters as the number of columns in the matrix, in the direction derived from the start or stop character decoded. Decode the symbol character bar-space sequences as per step 5.

e) Compute the symbol character cluster number K by:

$K = (E_1 - E_2 + E_5 - E_6 + 9) \bmod 9$

NOTE 1 This formula yields identical results to the equation given in 5.3.1.

The cluster number K shall equal 0, 3 or 6; otherwise the symbol character and its associated codeword are in error.

f) Retrieve the codeword from the decode table (Annex A) using the seven values (cluster value K and the values E_1, E_2, E_3, E_4, E_5 and E_6) as the key. These values can be calculated directly from the bar-space sequence values given in Annex A.

NOTE 2 The calculation implicitly uses the cluster number to detect all decode errors caused by single non-systematic one-module edge errors.

g) Once valid start and/or stop characters have been established, the codewords for the left row indicator and/or right row indicator shall be used to establish the symbol structure parameters. The inverse of the equations defined in 5.11.3.1 and 5.11.3.2 shall be used to establish the row number (F), the number of rows (r), the number of columns (c) and the error correction level (s).

h) Perform such other secondary checks (scan acceleration, absolute timing dimensions, quiet zones etc) as deemed prudent and appropriate for the particular characteristics of the reading device.

J.4 Filling the matrix

The following procedure shall be used to fill the matrix of rows (r) by columns (c) established by the initialisation procedure.

a) Set the initial value of the erasure count v to be equal to r x c.

b) For each scan, attempt to decode as many codewords as the number of columns of the matrix.

c) Valid decode results are placed in the matrix at their appropriate positions determined by the row number (from the row indicators) and the cluster value.

If row crossing occurs, the scan line will have different row numbers indicated by the left and right row indicators. The cluster number shall be used to interpolate the correct row number for each individual valid codeword.

EXAMPLE A decoded scan has valid start and stop characters and has a left row indicator with row number 7 and a right row indicator with row number 10. There are 10 columns in the matrix. The scan line has not decoded three codewords because it did not remain entirely in the one row for the full transition, however the position of these 'missing' codewords is known from element timings.

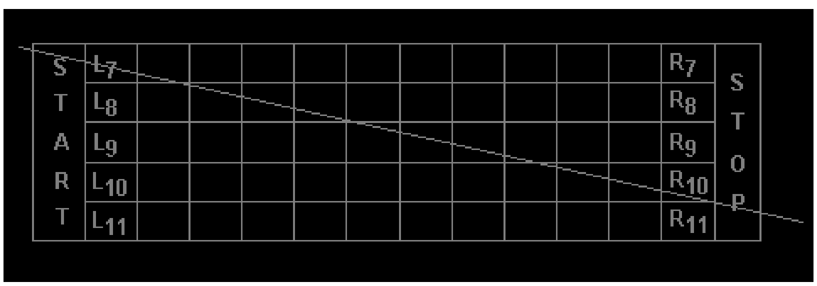


Figure J.2 — Schematic Showing a Scan Line Crossing Rows

The clusters are as follows: unknown, 6, 6, 6, unknown, 0, 0, unknown, 3, 3.

Using matrix notation of r (row), c (column), the codewords are filled in the positions:

unknown, (8, 2), (8, 3), (8, 4), unknown, (9, 6), (9, 7), unknown, (10, 9), and (10, 10)

NOTE This example is extreme in that it crosses four rows, but it still results in the successful decode of 70 percent of the codewords.

d) As the matrix is being filled, the erasure count v shall be reduced by one for each valid codeword.

e) If the error correction level is not equal to zero, error recovery may be attempted when the number of unknown codewords (the erasure count v) satisfies the equations in 5.7.2 (with $v = l$ and $f = 0$). If error recovery fails, then more codewords shall be collected.

f) If the error correction level is equal to zero, validate the two error correction codewords.

For more details on error detection and correction see Annex K.

J.5 Interpretation

Beginning from an initial state of the Alpha sub-mode of Text Compaction mode, the data codewords shall be interpreted according to the compaction modes.

Annex K
(normative)

Error correction procedures

When the total number of unknown codewords **v** is less than or equal to the value of l in the appropriate equation in 5.7.2, where $f = 0$, then the recovery scheme may be invoked. The unknown codewords shall be substituted by zeros and the position of the l th unknown codeword is j_l for $l = 1,2,\ldots, v$. Construct the symbol character polynomial:

$$C(x) = C_{n-1}x^{n-1} + C_{n-2}x^{n-2} + \ldots + C_1x^1 + C_0$$

where

n coefficients are the codewords read, with C_{n-1} being the first codeword;

n is the total number of codewords.

Calculate k syndrome values (S_1 to S_k) by evaluating:

$C(x)$ at $x = 3^i$

for $i = 1$ to $i = k$

where k is the number of error correction characters in the symbol $= 2^{s+1}$.

A circuit to generate the syndromes is shown in Figure K.1.

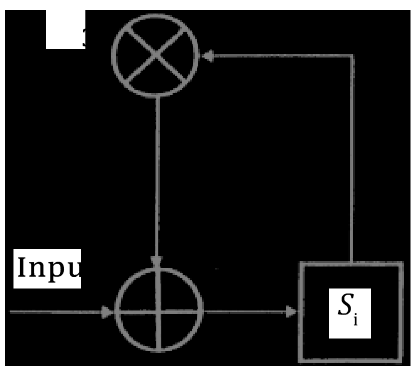


Figure K.1 — Symbol Syndrome Divider

Since the locations of unknown codewords in the symbol matrix are known from j_l for $l = 1, 2, \ldots v$, the error location polynomial for these known positions can be computed:

$$\sigma(x) = (1 - \beta_1 x)(1 - \beta_2 x)\ldots(1 - \beta_v x)$$

$$= 1 + \sigma_1 x + \ldots + \sigma_v x^v$$

where $\beta_l = 3^{j_l}$.

The error location polynomial, σ(x), can be updated to include the position of errors. This can be done by using the Berlekamp-Massey algorithm, see Reference [2].

At this point, verify that the number of erasures and errors satisfy the appropriate error correction capacity equation in 5.7.2.

Solving σ(x) = 0 yields the position of the t errors, where $t \geq 0$; if $t = 0$ there is no error. It is now necessary to compute the error value, e_{jl} for location j_l, $l = 1, \ldots, v + t$. To compute the error values one auxiliary polynomial, the Z-polynomial, is needed which is defined by:

$$Z(x) = 1 + (s_1 + \sigma_1)x + (s_2 + \sigma_1 s_1 + \sigma_2)x^2 + \ldots + (s_\eta + \sigma_1 s_{\eta-1} + \sigma_2 s_{\eta-2} + \sigma_\eta)x^\eta$$

where $\eta = v + t$.

The error value at location j_l is thus given by:

$$e_{j_l} = \frac{Z(\beta_l^{-1})}{\beta_l \prod_{i=1, i \neq l}^{\eta} (1 - \beta_i \beta_l^{-1})}$$

After solving successfully for the error values, the complements of the error values are added to the codewords in the corresponding locations.

Annex L
(normative)

Symbology identifier

The uniform methodology defined in ISO/IEC 15424 shall be used for reporting the symbology read, options set in the reader and any special features of the symbology encountered.

The symbology identifier for PDF417 is:

]Lm

where

] is the symbology identifier flag character (ASCII 93);

L is the symbology identifier for PDF417;

m is a modifier character with one of the values defined in Table L.1.

Table L.1 — Symbology Identifier Modifier Values for PDF417

m	Option
0	Reader set to conform with protocol defined in the original AIM USA (1994) and AIM Europe (1994) PDF417 specifications (see Annex M)[a]
1	Reader set to follow the protocol of this standard for Extended Channel Interpretation (see 5.17.2). All data characters 92 are doubled
2	Reader set to follow the protocol of this standard for Basic Channel operation (see 5.17.1). Data characters 92 are not doubled[b]

[a] When this option is transmitted, the receiver cannot determine reliably whether ECIs have been invoked, nor whether data byte 92 has been doubled in transmission.

[b] When decoders are set to this mode, unbuffered Macro PDF417 symbols, and symbols requiring the decoder to convey ECI escape sequences, cannot be transmitted.

This information shall not be encoded in the bar code symbol, but should be generated by the decoder after decoding and be transmitted as a preamble to the data message.

Annex M
(normative)

Transmission protocol for decoders conforming with original PDF417 standards

M.1 General

Earlier PDF417 symbology specifications supported: Basic Channel Mode, Global Label Identifiers (the precursor to the symbology-independent Extended Channel Interpretation) and Macro PDF417 (but without full integration with the ECI protocol). This Annex

— defines the transmission protocol compliant with the original specification, and which may still be used, and

— addresses issues of compatibility.

M.2 Basic Channel mode

In the Basic Channel, all data symbol characters are translated according to the compaction modes in effect, and are included in the data transmission as a sequence of 8-bit bytes. Start and stop characters, row indicators, the Symbol Length Descriptor, mode switching codewords and error correction codewords are not transmitted.

NOTE This is identical to the procedure of 5.17.1.

Original decoders should output symbology identifier]L0, or may not transmit a symbology identifier preamble.

M.3 GLI encoded symbols

Only GLI 0 and GLI 1 have been previously specified, but the transmission of all GLI/ECI escape sequences is supported by the original protocol. Three codewords (925, 926 and 927) signal the encodation of a GLI value and are decoded as byte values as follows:

a) If the GLI sequence begins with codeword 927:

1) Codeword 927 is transmitted as a 4-byte escape sequence 92, 57, 50, 55, which represents '\927' in the ASCII interpretation.

2) The next codeword represents the GLI number in the range 000 to 899. The codeword is converted to a 3-digit value. The 3-digit value is transmitted as the appropriate byte values (48 to 57), preceded by byte 92.

EXAMPLE

Symbol encodes: [927] [001]

Data transmission (byte): 92, 57, 50, 55, 92, 48, 48, 49

ASCII interpretation: \927\001

b) If the GLI sequence begins with codeword 926:

1) Codeword 926 is transmitted as a 4-byte escape sequence 92, 57, 50, 54, which represents '\926' in the ASCII interpretation.

2) The next two codewords (codewords 000 to 899 are permissible) represent the number of the ECI as follows:

Codeword 1 = ECI_no div 900 - 1

Codeword 2 = ECI_no mod 900

Each codeword is converted to a 3-digit value. The 3-digit value is transmitted as the appropriate byte values (48 to 57), preceded by byte 92.

EXAMPLE

Symbol encodes: [926] [136] [156]

Data transmission (byte): 92, 57, 50, 54, 92, 49, 51, 54, 92, 49, 53, 54

ASCII interpretation: \926\136\156

c) If the GLI sequence begins with codeword 925:

1) Codeword 925 is transmitted as a 4-byte escape sequence 92, 57, 50, 53, which represents '\925' in the ASCII interpretation.

2) The next codeword represents the number of the user defined GLI minus 810 900 (any codeword 000 to 899 is permissible). This codeword is converted to a 3-digit value. The 3-digit value is transmitted as the appropriate byte values (48 to 57), preceded by byte 92.

EXAMPLE

Symbol encodes: [925] [456]

Data transmission (byte): 92, 57, 50, 53, 92, 52, 53, 54

ASCII interpretation: \925\456

The procedure is repeated for each occurrence of a GLI.

NOTE 1 Illustrations of similar ECI examples, but utilizing the ECI protocol, are given in 5.17.2.

If the reverse solidus, or other character represented by byte 92 needs to be used as encoded data, transmission shall be as follows. Whenever byte 92 occurs as data, two bytes of that value shall be transmitted; thus a single occurrence is always an escape character and a double occurrence indicates true data.

EXAMPLE

Encoded data: A\\B\C

Transmission: A\\\\B\\C

The default escape character may be changed in the decoder (in which case the receiving system shall be configured to match), but the byte values 47 to 58 (generally interpreted as numeric digits) shall not be used.

NOTE 2 In the ECI compliant protocol (see 5.17.2), the escape character is fixed at 92.

As an option, decoders may have an operating mode where no escape character is defined; such readers cannot transmit escape sequences nor double any data characters. Thus, this mode cannot support the transmission of ECI escape sequences, nor Macro PDF417 Control Blocks.

M.4 Macro PDF417 symbols

When operating under the original PDF417 transmission protocol, once a PDF417 decoder has processed a Macro PDF417 symbol with a given file ID, it shall decode and transmit all of the symbols for that file ID before it may transmit any other symbols. This requirement applies under either of the following transmission modes.

M.4.1 Transmission in buffered mode

A buffered transmission system requires the decoder to collect the entire symbol set prior to its transmission. Processing of the mandatory fields of the Macro Control Block is dealt with internally. The transmission of optional fields can be individually enabled or disabled in the decoder. Optional fields, if present, should be transmitted once at the end of the entire data set. Each field shall begin with the transmission of the corresponding Macro PDF417 optional field tag sequence. The tag sequence consists of the codeword 923 followed by a tag value as defined in Table H.1; this sequence shall be transmitted using the escape character as defined in M.3. The high level decoded content of the field shall be transmitted after this tag sequence.

M.4.2 Transmission in unbuffered mode

An unbuffered transmission system allows the decoder to transmit the individual symbols as they are decoded.

When using the unbuffered scheme, transmission of the Macro PDF417 Control Header should be enabled, because symbols in the unbuffered scheme are not ordered internally by the reader. This allows the host system to impose the proper ordering on the received data.

Transmission of the Macro PDF417 Control Header may be enabled or disabled. The Macro PDF417 Control Header is a portion of the Macro PDF417 Control Block, (see Figure H.1) which consists of the marker codeword 928, the Segment Index (in Numeric Compaction mode), and the File ID codeword sequence. When transmission of the Control Header is enabled, the marker codeword and the File ID codewords should be transmitted using the escape character as defined in M.3. For example, the Macro PDF417 Control Header of the first symbol, Segment Index = 0, with a File ID (100, 200, 300) would be encoded in the symbol as the codeword sequence:

[928] [111] [100] [100] [200] [300]

and (assuming the default escape character 92) would be transmitted as:

Data transmission (byte):

92, 57, 50, 56, 48, 48, 48, 48, 48, 92, 49, 48, 48, 92, 50, 48, 48, 92, 51, 48, 48

ASCII interpretation: \92800000\100\200\300

If enabled, the Macro PDF417 Control Header shall be transmitted following the data encoded in the symbol.

When the last GLI sequence transmitted by the reader is other than GLI 0, then the transmitted data from that segment shall be terminated with the byte sequence 92, 57, 50, 55, 92, 48, 48, 48 (ASCII equivalent: \927\000), as if the symbol's data ended with the sequence of codewords [927] [000]. This reverts the interpretation of the next block back to GLI 0.

The transmission of optional fields can be individually enabled or disabled in the decoder. The enabled optional fields shall be transmitted with each Macro PDF417 symbol in which they have been encoded. Each field shall begin with the transmission of the corresponding Macro PDF417 optional field tag sequence. The tag sequence consists of the codeword 923 followed by a tag value as defined in Table H.1; this sequence shall be transmitted using the escape character as defined in M.3. The high level decoded content of the field shall be transmitted after this tag sequence.

Based only on the transmission of the encoded data stream, it can be difficult or impossible to determine where the boundary exists between the end of the Macro Control Block (especially if containing optional fields) and the beginning of the next symbol's data content. The system's transmission protocol (e.g. using the conventional transmission escape characters STX and ETX, or other 'hand shaking' procedures) may be used to determine the boundaries between transmitted Macro PDF417 symbols.

To facilitate checking that all symbols in a Macro PDF417 set are received in an unbuffered operation, the optional Segment Count field should be used whenever possible as part of the encoded Macro Control Block.

M.5 Transmission of reserved codewords using the original PDF417 protocol

When operating under the original PDF417 transmission protocol, decoders should transmit a reserved codeword as an escape character (default of 92) followed by three digits which represent the decimal value of the reserved codeword. The data codewords which follow the reserved codeword are interpreted and transmitted according to the compaction mode in effect prior to the reserved codeword. Specifically, the interpretation will be as if the reserved codeword inserted a latch codeword to the compaction mode already in effect.

Such a latch, when in Byte or Numeric Compaction mode, re-initialises a new 'grouping' of codewords. If the prevailing mode is Text Compaction, the effect is to re-initialise to the Alpha sub-mode of Text Compaction.

While this protocol can properly transmit the message syntax of any reserved codeword whose future definition is to provide a signalling function, it will not provide unambiguous output for a new compaction mode. Therefore, when using the original PDF417 transmission protocol, the receiver should discard any data following the escape sequence representing a newly defined compaction mode codeword.

M.6 Achieving compatibility between old and new PDF417 equipment

M.6.1 Encoders

The introduction of Extended Channel Interpretations, which are symbology-independent, means that it is logical to separate the functions of ECI encoding from symbology encoding. GLI encoding is de facto intrinsically linked to the PDF417 symbology. The encoded codeword stream is intended to be equivalent, whether the symbol has been encoded on existing or new encoders. It should be possible to encode, for example, data conforming with the interpretation of ECI 000123 (which itself has not been defined at the date of publication of this standard) under a PDF417 specific GLI capable encoder or on a first stage symbology-independent ECI encoder followed by a second stage PDF417 symbology encoder.

There are two constraints:

— the return-to-GLI 0 logic shall only be applied to GLI 0 (ECI 000000) and GLI 1 (ECI 000001);

— GLI 0 and 1 shall not be intermixed with other ECIs in the same symbol, or Macro PDF417 set.

M.6.2 Decoders

The key to interoperability between original and new protocol PDF417 decoders is the required transmission of the symbology identifier prefix whenever a decoder is configured for the new Extended Channel Mode operation, and the required use of the prefix whenever old and new PDF417 equipment is mixed at the same installation. That is, a decoder enabled for Extended Channel Mode operation (even if reading a mix of Basic Channel Mode and Extended Channel Mode symbols) will send a symbology identifier with every transmission.

NOTE The original AIM USA (1994) and AIM Europe (1994) PDF417 specifications did not require the use of a symbology identifier, even when doubling the escape character (default of 92). Compliance with the ECI protocol as specified in this standard requires the use of the symbology identifier.

Decoders shall be considered to be in conformance under one of the following conditions.

a) **Fully conforming with the ECI protocol and with this International Standard**:

   1) Transmitting the appropriate symbology identifiers.

   2) Capable of being set or switched to Basic Channel Mode or Extended Channel Mode operation.

   3) Transmitting the ECI protocol as specified in this standard (see 5.17.2).

   4) Processing Macro PDF417 as specified in this standard.

b) **Conforming with 1994 standards**:

   1) And interoperable with new equipment, and ECI encoded symbols.

      i) Transmitting the symbology identifier ‘]L0’.

      ii) Capable of being set or switched to Basic Channel Mode or Extended Channel Mode operation.

      iii) Transmitting the GLI protocol as specified in M.3.

      iv) Processing Macro PDF417 as specified in M.4.

   2) But not interoperable with new equipment, and ECI encoded symbols.

      i) Not transmitting a symbology identifier.

      ii) Capable of being set or switched to Basic Channel Mode or Extended Channel Mode operation.

      iii) Transmitting the GLI protocol as specified in M.3.

      iv) Processing Macro PDF417 as specified in M.4.

c) **Conforming with Basic Channel Mode only**:

   1) Transmitting the symbology identifier ‘]L0’ (old equipment) or ‘]L2 (new equipment), or transmitting no symbology identifier.

   2) Treating symbols containing ECI codewords as invalid.

   3) Treating Macro PDF417 symbols as invalid, unless the reader is operating in buffered mode, and transmission of the Macro Control Header is disabled.

Assuming that equipment is properly set up as above, this gives the receiver the ability to detect, and react properly to, the following conditions.

a) **If a symbology identifier of ‘]L1’ is present at the start of the transmission**:

   In this case, the receiver can be sure that the decoder is operating in Extended Channel Mode for the symbol scanned. Therefore all byte 92, when occurring as data, have been doubled whether or not the symbol contains ECIs or is part of a Macro PDF417 set. Single occurrences of byte 92 indicate the start of an escape sequence. All other features conform with this standard.

b) **If a symbology identifier of ‘]L2’ is present at the start of the transmission**:

   In this case, the receiver can be sure that the decoder is operating in Basic Channel Mode for the symbol scanned. Therefore, byte 92 will always represent a single byte of data.

   Symbols with ECI escapes shall be considered invalid. Macro PDF417 symbols shall be considered invalid, unless the reader is configured for buffered mode, and is configured to not transmit Macro PDF417 Control Headers.

c) **If a symbology identifier of ‘]L0’ is present at the start of the transmission, denoting the 1994 version of PDF417:**

This case is an exception because the original AIM USA (1994) and AIM Europe (1994) PDF417 specifications, although it does provide explicit Extended Channel Mode support, define ‘0’ (i.e. ‘no options set’) as the only option value for the PDF417 symbology identifier. Thus, existing PDF417 equipment, if fully compliant with the original AIM USA (1994) and AIM Europe (1994) PDF417 specifications, will not use the new option values to indicate whether Extended Channel Mode or Basic Channel Mode is in effect. Therefore, if the receiver sees ‘]L0’, then it should expect 1994 standard-compliant PDF417 behaviour. In particular:

1) The receiver cannot tell from the transmission whether the decoder is in Extended Channel Mode (always doubles the byte assigned as the escape character as per M.3) or Basic Channel Mode (never doubles any bytes); the decoder must be configured to match the expectations of the receiver.

2) If the decoder is set to Extended Channel Mode and if ECIs are encoded in the symbol, the decoder will transmit 1994 PDF417-style GLI escape sequences (as per M.3) rather than ECI escape sequence as defined in 5.17.2.

3) Using original protocol, if a Macro Control Block is present, the contents of the Macro Control Block follows, rather than precedes, the data bytes in the symbol.

d) **If no symbology identifier is present at the start of the transmission:**

In this case, either

1) the decoder is properly configured to support Basic Channel Mode symbols only. The receiving system is assured that no byte value is being doubled by the decoder and that any apparent ECIs in the data stream are accidental character combinations, or

2) the decoder is improperly configured for interoperability in an open system where ECI encoded symbols may be encountered.

Annex N
(informative)

Algorithm to minimise the number of codewords

The same data may be represented by different PDF417 codeword sequences through the use of different compaction modes and switching procedures. There shall be no prescribed procedure, but the following algorithm will tend to minimise the number of codewords required.

a) Let *P* point to the start of the data stream.

b) Set current encoding mode to Text Compaction.

c) Let *N* be the number of consecutive digits starting at *P*.

d) If *N* is ≥13 then

   1) latch to Numeric Compaction mode,

   2) encode the *N* characters using numeric compaction,

   3) advance *P* by *N*, and

   4) go to Step 3.

e) Else if *N* <13 then

   1) let *T* be the length of a Text Compaction mode character sequence starting at *P*. The sequence is terminated when either a character from a mode other than Text Compaction is detected or a numeric sequence of ≥13 digits is detected,

   2) if *T* is ≥5 then

      i) latch into Text Compaction mode,

      ii) encode the *T* characters using the Text Compaction mode,

      iii) advance *P* by *T*, and

      iv) go to Step 3,

   3) else if *T* <5 then

      i). let *B* be the length of the binary encodable sequence starting at *P*. The sequence is terminated when either a Text Compaction sequence of length ≥5 is found or a numeric sequence of length ≥13 is found,

      ii) if *B* is equal to 1 AND the current mode is Text Compaction, then

         I) shift into Byte Compaction mode,

         II) encode the single byte value using Byte Compaction mode,

         III) advance *P* by *B*, and

         IV) go to Step 3,

      iii) else

         I) latch into Byte Compaction mode,

II) encode the *B* bytes using Byte Compaction mode,

III) advance *P* by *B*, and

IV) go to Step 3.

Annex O
(informative)

Guidelines to determine the symbol matrix

O.1 Parameters affecting the determination of the matrix

A number of parameters should be used before printing to determine the symbol matrix in terms of the number of rows (r) and columns (c).

Each parameter addresses one single feature which may constrain the symbol matrix. In the equations which follow, A, c, k, n, Q_H, Q_V, r, X and Y conform with the definitions provided in 4.1.

The equations may be used in their own right or to construct a more complex algorithm.

— Parameter 1: Number of Rows: r

$3 \leq r \leq 90$ (see 5.2.1)

— Parameter 2: Number of Columns: c

$1 \leq c \leq 30$ (see 5.2.2)

— Parameter 3: X dimension

Defined by the application specification (see 5.8.1)

— Parameter 4: Y dimension

$Y \geq 3X$ (see 5.8.2)

— Parameter 5: Horizontal Quiet Zone: Q_H

$Q_H \geq 2X$ (see 5.8.3)

— Parameter 6: Vertical Quiet Zone: Q_V

$Q_V \geq 2X$ (see 5.8.3)

— Parameter 7: Width available for the symbol, W

$$W \geq (17c + 69) + 2Q_H$$

NOTE 1 This parameter could be limited by the scanner field of view or the label width.

— Parameter 8: Height available for the symbol, H

$$H \geq Yr + 2Q_V$$

NOTE 2 This parameter could be limited by the scanner field of view or the label width.

— Parameter 9: Matrix Parameters

$$(n + k) = (c * r) < 929$$

— Parameter 10: Symbol Aspect Ratio: *A*

Before the symbol size can be determined, the number of data codewords and error correction codewords must be calculated. The next step depends upon which parameters are constrained by the application. When the requirements of the application specify an overall symbol aspect ratio, then 0.2 gives guidance on calculating the number of data region columns needed to create a symbol of that aspect ratio. If instead the application constrains either the allowed height or width of the symbol (or both), then simpler calculations can be used. 0.1 shows this simpler algorithm that can be used when the symbol width is constrained.

- When an overall width W (including quiet zones) is specified, then the number of data columns can be calculated from the equation of Parameter 7 (rounding up to the nearest integer number of columns). The number of rows is then derived from the total number of codewords: $(n + k) = (c * r)$.
- The symbol aspect ratio A is the height to width of the symbol including quiet zones. To achieve a given value of A, the following equation can be solved, with respect to the number of columns (c). The equation assumes that the quiet zones are expressed in precise terms of X but the equation can be used in all cases to produce the best approximation of the number of columns (c).

$$A = \frac{H}{W} = \frac{rY + 2Q_V}{17X(c + 73)}$$

where

A, c, H, Q_V, r, W, X and Y are as defined in Clause 4;

Q_V is $2X$.

Since the number of rows can be expressed as

$$r = \left\lceil \frac{n + k}{c} \right\rceil$$

where

n and k are as defined in Clause 4.

the equation can be reformulated as:

$$A = \frac{\left[\frac{n+k}{c}\right]Y + 4X}{(17c+73)X} = \frac{(n+k)Y + 4cX}{(17c^2+73c)X} = \frac{(n+k)\frac{Y}{X} + 4c}{17c^2+73c}$$

Thus:

$$A(17c^2+73c) - \left[(n+k)\frac{Y}{X}\right] - 4c = 0$$

This equation can be expressed as:

$$17Ac^2 + (73A-4)c - \left[(n+k)Y/X\right] = 0$$

which (substituting x for c) is a quadratic equation in the form of:

$$ax^2 + bx + c = 0$$

Since the solution equation for a quadratic equation is

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

substituting the parameter values of PDF417, the solution equation for the quadratic equation, ignoring the negative value, becomes:

$$c = \frac{-(73A-4) + \left[(73A-4)^2 + 4(17A)\left[(n+k)Y/X\right]\right]^{0,5}}{2(17A)}$$

The value of n is dependent on the number of pad codewords and this is not known until the matrix parameters are determined. However, the number of source codewords is known. As $m + 1 \leq n$ this can be substituted in the above equation as follows:

$$c = \frac{-(73A-4) + \left[(73A-4)^2 + 4(17A)\left[(m+1+k)Y/X\right]\right]^{0,5}}{2(17A)}$$

Solving the positive value of c produces a result which is not an integer. The nearest integer value of c gives the best value of the number of columns to achieve the aspect ratio.

The number of rows is given by:

$$r = INT\left[(m+1+k)/c\right] + 1$$

If $(c * r) \geq m + 1 + k + c$

then $r = r - 1$

As $(c * r) = (n + k)$, the number of pad codewords is $(n + k) - (m + 1 + k)$

EXAMPLE To achieve an aspect ratio A = 0,5 for a PDF417 symbol where $m + 1 + k = 277$, X = 0,33 mm and Y = 1,00 mm

$$c = \frac{-\left(\left(73 * 0,5\right) - 4\right) + \left\{\left(\left(73 * 0,5\right) - 4\right)^2 + 4\left(17 * 0,5\right)\left(\frac{277 * 1,00}{0,33}\right)\right\}^{0,5}}{2\left(17 * 0,5\right)}$$

$$c = \frac{-32,5 + \left(1056 + 28539\right)^{0,5}}{17}$$

$$c = \frac{-32,5 + 172,0}{17}$$

$$c = \frac{139,5}{17} = 8,21 = 8$$

$$r = INT\left(\frac{277}{c}\right) + 1 = INT\left(34,6\right) + 1 = 35$$

$$(m + 1 + k) \leq (c * r) < 929$$

277 ≤ 280 < 929

The number of pad codewords required is:

$$(c * r) - (m + 1 + k)$$

280 – 277 = 3

This symbol has 35 rows and 8 columns and measures 68,97 mm wide by 36,32 mm high, an actual aspect ratio of 0,527.

O.2 Guidelines should any parameters not be achieved

If the symbol fails to conform with the intended label size

a) reduce the data content, if possible,

b) increase the label size in one or both dimensions,

c) reduce the error correction level, and

d) reduce the X-dimension or the module height (Y).

Annex P
(informative)

Calculating the coefficients for generating the error correction codewords – worked example

The following generator polynomial shall be used to calculate coefficients for each error correction level:

$g_k(x) = (x - 3)\ (x - 3^2)\ (x - 3^3)\ ....\ (x - 3^k)$

$= \alpha_0 + \alpha_1 x + \alpha_2 x^2 + ...\ \alpha_{k-1} x^{k-1} + x^k$

where

$g_k(x)$ is the generator polynomial;

k is the total number of error correction codewords;

α_j is the coefficient of powers of x produced by the generator polynomial $g_k(x)$.

First expand the above equation. Next, calculate the complement of the coefficient from the above.

For $\alpha_j = \alpha_0\ ....\ \alpha_{k-1}$

BEGIN

$\alpha_j = \alpha_j \bmod 929$

END

EXAMPLE

Calculate generator polynomial coefficients for error correction level 1

s	$= 1$	error correction level 1
k	$= 2^{s+1} = 4$	(number of error correction codewords)
$g_4(x)$	$= (x - 3)\ (x - 3^2)\ (x - 3^3)\ (x - 3^4)$	
	$= 59\ 049 - 29\ 160x + 3\ 510x^2 - 120x^3 + x^4$	
α_0	$= 59\ 049 \bmod 929$	$= 522$
α_1	$= -29\ 160 \bmod 929$	$= 568$
α_2	$= 3\ 510 \bmod 929$	$= 723$
α_3	$= -120 \bmod 929$	$= 809$

NOTE Annex F contains all of the coefficient values necessary to encode a PDF417 symbol of any error correction level.

Annex Q
(informative)

Generating the error correction codewords - worked example

To generate the error correction codewords, the algorithm in 5.10 shall be used. (The notation used in the example below is identical to that in 5.10.)

EXAMPLE

The data PDF417 is represented by the codewords 5, 453, 178, 121, 239, when preceded by the Symbol Length Descriptor. There are no pad codewords. Then:

n = 5 (number of codewords including symbol length descriptor)

d_4 = 5

d_3 = 453

d_2 = 178

d_1 = 121

d_0 = 239

Selecting an error correction level of 1 gives:

s = 1

k = 2^{1+1} = 4

$\alpha_0,\dots,\alpha_3$ = 522, 568, 723, 809

NOTE The example is artificially simple, having only 5 data codewords and 4 error correction codewords. However, it fully illustrates the entire process which expands with increases in the number of data codewords and the number of error correction codewords.

The calculations are:

Initialise $E_0, \dots, E_3$ to 0

$t_1 = (d_4 + E_3) \bmod 929 = (5 + 0) \bmod 929 = 5$

$t_2 = (t_1 \times \alpha_3) \bmod 929 = (5 \times 809) \bmod 929 = 329$

$t_3 = 929 - t_2 = 929 - 329 = 600$

$E_3 = (E_2 + t_3) \bmod 929 = (0 + 600) \bmod 929 = 600$

$t_2 = (t_1 \times \alpha_2) \bmod 929 = (5 \text{ x } 723) \bmod 929 = 828$

$t_3 = 929 - t_2 = 929 - 828 = 101$

$E_2 = (E_1 + t_3) \bmod 929 = (0 + 101) \bmod 929 = 101$

$t_2 = (t_1 \times \alpha_1) \bmod 929 = (5 \times 568) \bmod 929 = 53$

$t_3 = 929 - t_2 = 929 - 53 = 876$

$E_1 = (E_0 + t_3) \bmod 929 = (0 + 876) \bmod 929 = 876$

$t_2 = (t_1 \times \alpha_0) \bmod 929 = (5 \times 522) \bmod 929 = 752$

$t_3 = 929 - t_2 = 929 - 752 = 177$

$E_0 = t_3 \bmod 929 = 177 \bmod 929 = 177$

$t_1 = (d_3 + E_3) \bmod 929 = (453 + 600) \bmod 929 = 124$

$t_2 = (t_1 \times \alpha_3) \bmod 929 = (124 \times 809) \bmod 929 = 913$

$t_3 = 929 - t2 = 929 - 913 = 16$

$E_3 = (E_2 + t_3) \bmod 929 = (101 + 16) \bmod 929 = 117$

$t_2 = (t_1 \times \alpha_2) \bmod 929 = (124 \times 723) \bmod 929 = 468$

$t_3 = 929 - t_2 = 929 - 468 = 461$

$E_2 = (E_1 + t_3) \bmod 929 = (876 + 461) \bmod 929 = 408$

$t_2 = (t_1 \times \alpha_1) \bmod 929 = (124 \times 568) \bmod 929 = 757$

$t_3 = 929 - t_2 = 929 - 757 = 172$

$E_1 = (E_0 + t_3) \bmod 929 = (177 + 172) \bmod 929 = 349$

$t_2 = (t_1 \times \alpha_0) \bmod 929 = (124 \times 522) \bmod 929 = 627$

$t_3 = 929 - t_2 = 929 - 627 = 302$

$E_0 = t_3 \bmod 929 = 302 \bmod 929 = 302$

$t_1 = (d_2 + E_3) \bmod 929 = (178 + 117) \bmod 929 = 295$

$t_2 = (t_1 \times \alpha_3) \bmod 929 = (295 \times 809) \bmod 929 = 831$

$t_3 = 929 - t_2 = 929 - 831 = 98$

$E_3 = (E_2 + t_3) \bmod 929 = (408 + 98) \bmod 929 = 506$

$t_2 = (t_1 \times \alpha_2) \bmod 929 = (295 \times 723) \bmod 929 = 544$

$t_3 = 929 - t_2 = 929 - 544 = 385$

$E_2 = (E_1 + t_3) \bmod 929 = (349 + 385) \bmod 929 = 734$

$t_2 = (t_1 \times \alpha_1) \bmod 929 = (295 \times 568) \bmod 929 = 340$

$t_3 = 929 - t_2 = 929 - 340 = 589$

$E_1 = (E_0 + t_3) \bmod 929 = (302 + 589) \bmod 929 = 891$

$t_2 = (t_1 \times \alpha_0) \bmod 929 = (295 \times 522) \bmod 929 = 705$

$t_3 = 929 - t_2 = 929 - 705 = 224$

$E_0 = t_3 \bmod 929 = 224 \bmod 929 = 224$

$t_1 = (d_1 + E_3) \bmod 929 = (121 + 506) \bmod 929 = 627$

$t_2 = (t_1 \times \alpha_3) \bmod 929 = (627 \times 809) \bmod 929 = 9$

$t_3 = 929 - t_2 = 929 - 9 = 920$

$E_3 = (E_2 + t_3) \bmod 929 = (734 + 920) \bmod 929 = 725$

$t_2 = (t_1 \times \alpha_2) \bmod 929 = (627 \times 723) \bmod 929 = 898$

$t_3 = 929 - t_2 = 929 - 898 = 31$

$E_2 = (E_1 + t_3) \bmod 929 = (891 + 31) \bmod 929 = 922$

$t_2 = (t_1 \times \alpha_1) \bmod 929 = (627 \times 568) \bmod 929 = 329$

$t_3 = 929 - t_2 = 929 - 329 = 600$

$E_1 = (E_0 + t_3) \bmod 929 = (224 + 600) \bmod 929 = 824$

$t_2 = (t_1 \times \alpha_0) \bmod 929 = (627 \times 522) \bmod 929 = 286$

$t_3 = 929 - t_2 = 929 - 286 = 643$

$E_0 = t_3 \bmod 929 = 643 \bmod 929 = 643$

$t_1 = (d_0 + E_3) \bmod 929 = (239 + 725) \bmod 929 = 35$

$t_2 = (t_1 \times \alpha_3) \bmod 929 = (35 \times 809) \bmod 929 = 445$

$t_3 = 929 - t_2 = 929 - 445 = 484$

$E_3 = (E_2 + t_3) \bmod 929 = (922 + 484) \bmod 929 = 477$

$t_2 = (t_1 \times \alpha_2) \bmod 929 = (35 \times 723) \bmod 929 = 222$

$t_3 = 929 - t_2 = 929 - 222 = 707$

$E_2 = (E_1 + t_3) \bmod 929 = (824 + 707) \bmod 929 = 602$

$t_2 = (t_1 \times \alpha_1) \bmod 929 = (35 \times 568) \bmod 929 = 371$

$t_3 = 929 - t_2 = 929 - 371 = 558$

$E_1 = (E_0 + t_3) \bmod 929 = (643 + 558) \bmod 929 = 272$

$t_2 = (t_1 \times \alpha_0) \bmod 929 = (35 \times 522) \bmod 929 = 619$

$t_3 = 929 - t_2 = 929 - 619 = 310$

$E_0 = t_3 \bmod 929 = 310 \bmod 929 = 310$

Finally calculate the complement of the results from above, to get the 4 error correction codewords for the encoded data **PDF417** as follows:

$E_3 = 929 - E_3 = 929 - 477 = 452$

$E_2 = 929 - E_2 = 929 - 602 = 327$

$E_1 = 929 - E_1 = 929 - 272 = 657$

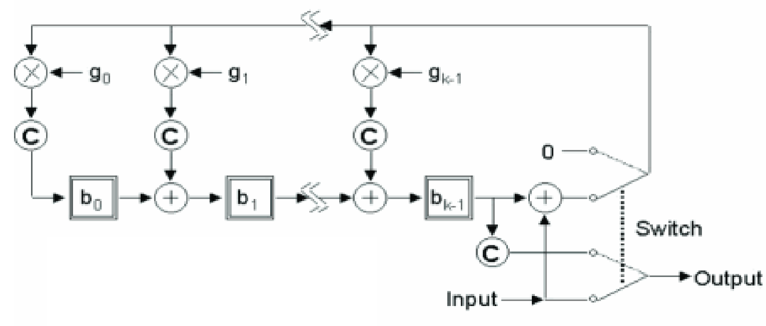
$E_0 = 929 - E_0 = 929 - 310 = 619$

Annex R
(informative)

Division circuit procedure for generating error correction codewords

This procedure is an alternative procedure to that specified in 5.10 and uses a division circuit as the basis of determining the error correction codewords.

The division circuit shall be as illustrated in Figure R.1.



Key

© modulo complement

⊕ modulo addition

⊗ modulo multiplication

Figure R.1 — Error correction codeword encoding circuit

The registers b_0 through to b_{k-1} shall be initialised as zeros. The modulo mathematics shall be defined by the following equations:

$$x \oplus y \equiv (x + y) \bmod 929$$

$$x \otimes y \equiv (x \times y) \bmod 929$$

$$© x = (929 - x) \bmod 929$$

where

x and y are numbers from 0 to 928;

⊕ is modulo addition;

⊗ is modulo multiplication;

© is the modulo complement.

There shall be two phases to generate the encoding. In the first phase, with the switch in the down position, the symbol data is passed both to the output and the circuit. The first phase is complete after n clock pulses. In the second phase ($n + 1$ ... $n + k$ clock pulses), with the switch in the up position, the error

correction codewords E_{k-1}, ..., E_0 are generated by flushing the registers in order and complementing the output while keeping the data input at 0.

Annex S
(informative)

Additional guidelines for the use of PDF417

S.1 Autodiscrimination compatibility

PDF417 may be read by suitably programmed bar code decoders which have been designed to autodiscriminate it from other symbologies. The decoder's valid set of symbologies should be limited to those needed by a given application to maximise reading security.

S.2 Pixel-based printing

S.2.1 General principles

Graphics software used to create bar codes on pixel-based printers must scale each bar and space exactly to the pixel pitch of the printer being used. For edge to similar edge decodable symbologies like PDF417, the number of pixels comprising each symbol character must be a fixed and constant integer multiple of the number of modules in the symbol character. For PDF417, the number of modules is 17 for the Start Pattern, other symbol characters, and 18 for the Stop Pattern. Therefore, a given printer can only print a certain set of *X* dimensions.

Compensation for uniform bar width growth (or loss) must be in equal offsetting amounts on all bars and spaces in the symbol. This may be accomplished by changing an integer number of pixels from dark to light or light to dark in the same manner for each bar-space pair in the symbol and for the last bar in the symbol. For example, all pixels along the same edge of every bar in the symbol could be changed from dark to light, or pixels along both edges of every bar in the symbol could be changed from dark to light, provided that the printer resolution is sufficient to allow this to be performed satisfactorily. Any set of dark to light or light to dark pixel changes is acceptable provided the adjustment is performed consistently across the whole symbol and does not change the edge to similar edge measurements or the total symbol character width. Failure to follow these principles results in degraded symbol quality and often results in unreadable symbols.

General purpose printing software designed to support a wide range of printers should provide the user with the capability of adjusting the *X* dimension and bar width growth or loss.

S.2.2 Programmer's Example

These principles can be reduced to the following rules for digital bar code design files.

a) Convert the desired *X* dimension to a module size in pixels rounded down to the nearest integer.

b) Determine the number of pixels corresponding to the desired compensation for uniform bar width growth and round up to the next larger integer.

c) Apply the above results to determine the pixel count of every bar and space in the symbol.

EXAMPLE Using digital bar code design files with a printing device with 24 dots per mm, create a 0,27 mm *X* dimension symbol with 0,06 mm of bar width reduction.

The module size is 24 dots/mm × 0,27 mm/module = 6,5 pixels, which rounds down to 6 pixels per module.

The bar growth compensation is 0,06 mm x 24 dots/mm = 1,4 pixels, which rounds up to 2 pixels.

This process results in the following pixel count for bars and spaces as illustrated in Table S.1.

Table S.1 — Example of correcting pixels for imaging resolution and bar width reduction

Element width (modules)	Nominal width (pixels)	Corrected pixel count	
		Bars	Spaces
1	6	4	8
2	12	10	14
3	18	16	20
4	24	22	26
5	30	28	32
6	36	34	38
8	48	46	n/a

Bibliography

[1] ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

[2] Blahut, R.E. Theory and Practice of Error Control Codes, published by Addison Wesley, 1984, p. 260, etc.

[3] AIM USA Uniform Symbology Specification PDF417, published by AIM USA, 1994

[4] Europe Uniform Symbology Specification AIM PDF417, published by AIM Europe, 1994

[5] ANSI X3.4, *Coded Character Sets — 7-bit American National Standard Code for Information Interchange (7-bit ASCII) (equivalent to the US national version of ISO/IEC 646)*

[6] AIM Inc. International Technical Standard: ITS/04-001, *Extended Channel Interpretations — Part 1: Identification Schemes and Protocols*[1)]

[7] AIM Inc. ITS/04-001: International Technical Standard: *Extended Channel Interpretations — Part 2: Registration Procedure for Coded Character Sets and Other Data Formats — Character Set Register*

1) Published by AIM Global, 125 Warrendale-Bayne Road, Suite 100, Warrendale, PA 15086, USA.

ICS 35.040

Price based on 108 pages

Exhibit 9

ACCURATE DATA

The Bar Code Experts

SEPTEMBER 1, 2017 BY RROBERTS

2D Codes vs Stacked Linear Codes

Here are two barcode symbols that both encode the string “12345678”:

Which of these codes is a 2D code? The one on the right is Datamatrix code, a true two dimensional code. The one on the left is PDF417, a stacked linear code; it looks like a two dimensional barcode, but it isn’t.

2D codes store data in both the X and Y coordinates. Linear codes only contain data in one dimension. This is easy to see in a normal linear code.

C O D E 3 9

It doesn't matter where the scanner goes across the code, data is only encoded in the widths of the bars and spaces. Datamatrix characters are encoded in a matrix of 5 by 5 cells and have to be read by a camera.

Stacked linear codes are really a bunch of small linear barcodes stacked on top of one another. Each row has a row indicator or number, so a 1D scanner such as a laser is capable of reading these codes by sweeping across the code while the decoder keeps track of the row numbers and puts together the final output. Check the specs of your scanner, not all 1D scanners will read PDF417 symbols.

Other stacked symbologies besides PDF417 are Code 49, Code 16K, and GS1 Databar Stacked.

Note the size difference between the PDF417 and the Datamatrix symbol above. Not many new applications use PDF417 because of the size and density advantage of Datamatrix.

Other 2D codes are Maxi Code, Aztec Code, and the ubiquitous QR Code.

SYMBOLOGIES

CODE 16K, CODE 49, GS1 DATABAR STACKED, PDF417 IS NOT A 2D CODE, STACKED SYMBOLOGIES

Exhibit 10

Can the OptimusPDA read 2D symbologies ?

Oct 7, 2014 · HSM Article

ARTICLE NUMBER
000026110

LAST MODIFIED DATE
10/7/2014 4:23 AM

QUESTION/PROBLEM

Can the OptimusPDA read 2D symbologies ?

Can the OptimusPDA read Datamatrix codes from a mobile phone?

APPLIES TO

- SP5700 OptimusPDA, SP5701 OptimusPDA, SP5721 OptimusPDA

RESOLUTION

The OptimusPDA SP5700 or SP5701 cannot read 2D symbologies because its scan engine is a laser engine capable of decoding only 1D symbologies.

The OptimusPDA SP5721, has been successfully tested with different bar code symbologies (Aztec, Datamatrix) and with different scan engines (5100 imager with aimer and the IS4910 imager with aimer (VuQuest))

FILE 1

FILE 2

FILE 3

FILE 4

RELATED ARTICLES

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EXHIBIT D

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION

HONEYWELL INTERNATIONAL INC., HAND HELD PRODUCTS, INC., and METROLOGIC INSTRUMENTS, INC., Plaintiffs, v. OPTO ELECTRONICS CO., LTD., Defendant and Counterclaim Plaintiff, v. HONEYWELL INTERNATIONAL INC., HAND HELD PRODUCTS, INC., and METROLOGIC INSTRUMENTS, INC., Counterclaim Defendants.	Case No. 3:21-cv-00506 JURY TRIAL DEMANDED

EXPERT REPORT OF DR. YNJIUN PAUL WANG, Ph.D.

TABLE OF CONTENTS

I. INTRODUCTION

1. My name is Dr. Ynjiun Paul Wang. I have been retained by Honeywell International Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. ("Honeywell") to investigate and opine on certain issues related to the PDF417 and MicroPDF417 symbologies.

A. Scope of Opinions

2. This report is based on information currently available to me. To the extent additional information becomes available, I reserve the right to continue my investigation and study, and thus may expand or modify my opinions as my investigation and study continues. I may also supplement my opinions in response to any additional information that becomes available to me, any matters raised by the Defendant and/or opinions rendered by Defendant's experts, or in light of any relevant orders from the Court.

B. Education and Work Experience

3. A complete listing of my qualifications, educational background, and professional experience relevant to this Expert Report can be found in my *Curriculum Vitae*, which is attached as Exhibit A.

4. As my CV shows, I began working in the field of symbologies (including 1D/2D barcodes) and other indicia while I was studying in my Ph.D. program. I continued working in the field from 1990 through 2013, including in my work for Symbol (now part of Zebra), Telxon, Hand Held Products, and Honeywell.

5. I have experience with many different symbologies including various 1D barcode and 2D barcodes. I invented and developed a two-dimensional barcode standard, PDF417, during my time at Symbol Technologies.

C. Compensation

6. I am being compensated for my work in this matter at my standard consulting rate of $1000 per hour, plus any reasonable expenses. No part of my compensation is contingent upon the outcome of this litigation. I have no other interests in this litigation or with any of the parties.

II. SUMMARY OF OPINIONS

7. I have been asked for my opinion as to whether the PDF417 and MicroPDF417 symbologies are two-dimensional symbologies. It is my opinion that they are two-dimensional symbologies. Also, I note that the ISO/IEC 15438-2015 international standards explicitly recite that "PDF417 is a bar code symbology with the following basic characteristics: . . . g) Code type: continuous, multi-row two-dimensional" in Section 5.1.1(g).

III. MATERIALS CONSIDERED

8. In preparing this Report, I relied on a variety of sources and documents in forming my opinions, including any materials cited in this Report. Below is a list of materials that I have considered in creating this Report.

List of Materials Considered
ISO/IEC 15438-2015
ISO/IEC 15438-2006
ISO/IEC 15434 (ANSI MH10.8.3)
ISO/IEC 24728-2006
U.S. Patent No. 5,304,786
MIL-STD-129P
MIL-STD-129R w/CHANGE 2

9. My analysis is continuing, and it is my understanding that discovery is ongoing in certain respects. Accordingly, I reserve the right to file a supplemental expert report if necessary and to rely on, for example, additional deposition testimony, documents, and/or other information that becomes available between now and the time of trial.

10. I further reserve the right to provide rebuttal opinions and testimony in response to Defendant's reports, contentions, and fact witnesses.

IV. MOTIVATION FOR THE DEVELOPMENT OF PDF417

11. In the late 1980s, while I was working on my Ph.D. studies at Stony Brook University, I was approached by my thesis advisor about a logistics problem the U.S. military was having and later signified by Operation Desert Storm.

12. When a major shipment of cargo or other materials in numerous large containers were sent to the Middle East, the military had problems understanding the many different items/containers that could be contained within a cargo. This led to thousands of cargo shipments being left unopened.

13. Using a linear barcode could not solve the problem, given that there was no practical way of using hundreds of barcodes to indicate all of the contents in a cargo.

14. Moreover, many deployments did not have access to the Internet at the time, therefore they could not use a barcode as an index to download the contents of a cargo over the Internet.

15. As a result of this problem, the military sent a request to Symbol Technologies to determine how many bytes could a symbology encode into one, two-dimensional square inch of real estate. This question was the starting point for the development of the two-dimensional symbology of PDF417.

16. A single PDF417 2D symbol can contain a maximum of 1108 bytes. As a result, a single PDF417 2D symbol can hold the information contained in hundreds of UPC 1D bar codes. Thus, a single PDF417 2D symbol could often identify all of the contents of a cargo, so that the military could know everything received without having to open each cargo and manually sort through it all.

17. In fact, the Department of Defense ultimately adopted the PDF417 2D symbology in its Military Marking for Shipment and Storage standard (MIL-STD-129P), which says that "The MSL [Military Shipping Label] will also include a 2D (PDF417) symbol in accordance with ISO/IEC 15438 and ISO/IEC 15434 (ANSI MH10.8.3), formatted in accordance with Table IV of this standard and as directed in the Defense Transportation Regulation (DTR) DoD 4500.9-R." Ex. B at p. 23.

18. The original Military Marking for Shipment and Storage Standard shows an MSL in FIGURE 2c and states that "The MSL shall be completed as follows to include in-the-clear-text or descriptive information, linear (Code 39) bar codes with HRI, and a 2D (PDF417) symbol." *Id.* at p. 26. The standard refers to "2D (PDF417)" over 60 times.

FIGURE 2c. MSL with Express Service bar codes.

(Recommended label size is 4 inches by 6 inches).

19. The current version of this standard, MIL-STD-129R w/CHANGE 2 continues to use PDF417 and refers to “2D (PDF417)” over 100 times. Ex. C.

V. PDF417 IS A TWO-DIMENSIONAL SYMBOLOGY

20. PDF417 is a 2D symbology.

21. ISO/IEC 15438 specifies the requirements for the barcode symbology PDF417. ISO/IEC 15438 is in its third edition, with the most recent edition being 2015.

22. One aspect of PDF417 that makes it one of the most robust symbologies is the fact that it can be decoded by any of a CMOS imager, CCD imager, or laser-based bar code reader, assuming the device has the correct software and hardware.

23. In a one-dimensional (1D) symbology, data is encoded only horizontally in one row. The height of the barcode symbol is immaterial and simply used for redundancy.

24. In PDF417, data is encoded both horizontally and vertically.

25. A single PDF417 2D symbol can contain up to 90 rows of information in the vertical direction.

26. A single PDF417 2D symbol is not simply a collection of independent rows stacked on top of one another.

27. When a laser scanner is used to scan a PDF417 2D symbology, it is often the case that the laser will experience cross-row confusion, where it is scanning more than just one row at any given pass. PDF417 allows for this occurrence by including a cluster number (or checksum) for each codeword. The cluster number in the first row is 0, then 3 in the second row, then 6 in the third row. The pattern then repeats, 0 then 3 then 6.

28. Thus, if a single pass shows cluster numbers of 0, 0, 3, 3, 6, 6, then we know the scan captured the first two codewords of the first row, then middle two codewords of the second row, and the final two codewords of the third row, crossing downwards. Similarly, if a single pass shows cluster numbers of 3, 3, 0, 0, 6, 6, then we know the scan captured the first two codewords of the fifth row, then middle two codewords of the fourth, and the final two codewords of the third

row, crossing upwards. These aspects of PDF417 are discussed in Section 5.11.1 Clusters, as described in ISO/IEC 15438-2015.

29. Additionally, PDF417 uses error correction over the entire symbol. Thus, even if not every codeword can be properly recorded or decoded, the entire symbol can still be decoded as long as the number of damaged codewords are within error correction capability. This error correction operates in the entire PDF417 2D symbol as a whole.

30. ISO/IEC 15438 defines PDF417 as a "continuous, multi-row two-dimensional" code type in both ISO/IEC 15438-2015 and ISO/IEC 15438-2006 specifications.

31. PDF417 is a two-dimensional barcode symbology that has two or more adjacent and associated rows of varying-width parallel bars and spaces. ISO/IEC 15438 states that PDF417 has between 3 and 90 rows. This further confirms that PDF417 is a two-dimensional barcode symbology.

32. The below image from ISO/IEC 15438 shows a PDF417 symbology having ten rows. I annotated one row in blue and another row in red.

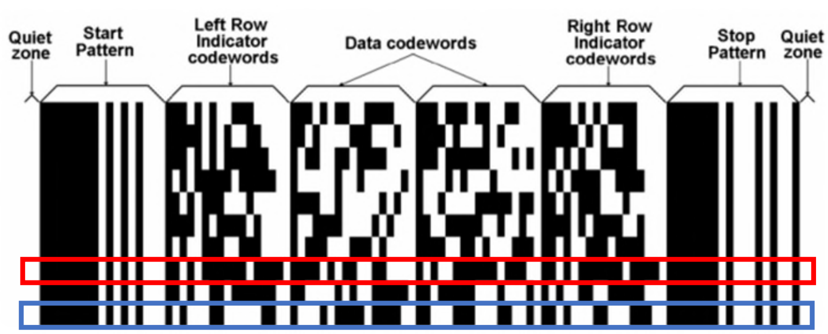


Figure 1 — PDF417 symbol structure

Figure 1 of ISO/IEC 15438-2015 (annotated).

33. Additionally, in the "Reference decode algorithm for PDF417", the data are arranged in a two-dimensional matrix, as the standard, ISO/IEC 15438-2015 shows in Section J.3. This matrix can be populated in many different directions.

VI. MICROPDF417 IS A TWO-DIMENSIONAL SYMBOLOGY

34. MicroPDF417 is a two-dimensional barcode symbology.

35. ISO/IEC 24728 defines the requirements for the barcode symbology MicroPDF417. ISO/IEC 24728 is in its first edition published in 2006.

36. ISO/IEC 24728 describes MicroPDF417 as a multi-row symbology derived and closely based on PDF417. It further describes MicroPDF417's basic characteristics as a "multi-row symbology which may be utilized by applications needing to encode a moderate amount of data in a two-dimensional symbol . . ., and when minimizing symbol size is a primary concern," as specified in Section 5.1.1 Basic Characteristics of ISO/IEC 24728:2006.

37. MicroPDF417 is a two-dimensional barcode symbology that has two or more adjacent and associated rows of varying-width parallel bars and spaces. ISO/IEC 24728 states that MicroPDF417 has between 4 to 44 rows. This further confirms that MicroPDF417 is a two-dimensional barcode symbology.

38. The below image from ISO/IEC 24728 shows a MicroPDF417 symbology having twenty rows. I annotated one row in blue and another row in red.

1 Column by 20 Rows,
Encoding:
'ABCDEFGHIJKLMNOPQRSTUV'

Figure 1 of ISO/IEC 24728 (annotated).

VII. U.S. PATENT NO. 5,304,786

39. After joining Symbol Technologies, I filed several patent applications, along with my co-inventors, directed to our work on PDF417, including U.S. Patent No. 5,304,786. I am one of the three named inventors of the patent, although my name is misspelled on the cover page. Theodosios Pavlidis was my thesis advisor, and Jerome Swartz was the CEO of Symbol Technologies.

40. This patent is entitled "High Density Two-Dimensional Bar Code Symbol."

41. On multiple occasions, the patent explicitly describes PDF417 as a two-dimensional bar code symbology, including in the Background of the Invention, Summary of the Invention, the Summary of Label Row-Wise Organization, Brief Description of the Drawings, Nonvolitile Memory and Computer System, Additional Illustrative Embodiments. The rest of the description also describes the symbology as two dimensional.

42. This patent also describes the clusters and error correction that I mention above.

VIII. USE OF DEMONSTRATIVES

43. I expect and understand that I will have the opportunity to use demonstrative exhibits at trial to summarize, explain, and/or support my opinions.

IX. CONCLUSION

44. For all the reasons discussed in this Report, it is my opinion that PDF417 and MicroPDF417 (and thus any composite code that uses PDF417 or MicroPDF417) are two-dimensional bar code symbologies. It is also my opinion that the industry, including by way of the standards-setting organizations, have recognized PDF417 and MicroPDF417 as two-dimensional bar code symbologies.

Dated: October 21, 2022

10/21/2022

Dr. Ynjiun Paul Wang

EXHIBIT E

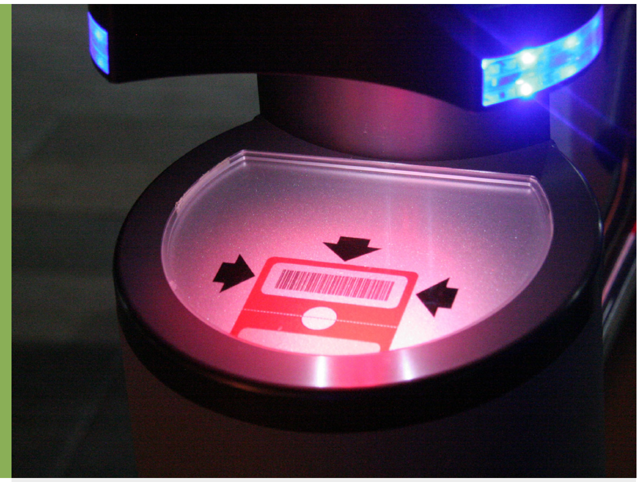
OPTICON

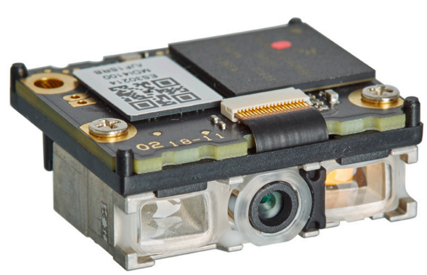
Engines

MDI-4050/4150

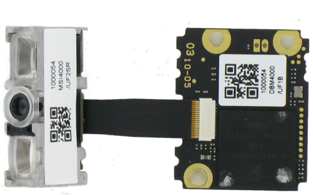
2D CMOS Imager

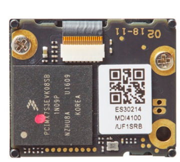
The MDI-4x50 is an extremely small 2D CMOS imager with a fast shutter speed, a high speed processor and increased motion tolerance. It rapidly and easily scans barcodes off cell phone, tablet and computer displays.





scale 100%





Highlights

- Ultra-low profile, full spectrum illuminated 2D CMOS imager
- Perfect for integration into small, space constrained mobile, medical, or retail barcode scanning devices
- High performance, lower power 800MHz CPU and an ultra-fast 100 fps CMOS imager sensor enable high speeding scanning of 1D and 2D barcodes and OCR fonts
- Fast global shutter technology providing exceptional motion tolerance for moving applications
- Improved scanning of curved, wide, poorly printed and damaged barcodes
- Data editing program function captures up to 16 codes on multiple images simultaneously
- Single line green LED and warm, white LED illumination makes it easy to aim while providing safety and an extended service life
- Low power and an adjustable power consumption to fit your design needs
- Communication interface: serial CMOS: 12 pin FFC connector, serial TTL, USB
- Engineering kit available – enables faster time to market
- Two year warranty

MDI-4050/4150

Product Specifications

Communication

Serial CMOS: 12 pin FFC connector: Serial TTL, USB

Power

Voltage requirement: 3.0V ~ 5.5V
Current consumption: Max. 300 mA
Low power current: 9 mA
Suspend mode: <2 mA

2D Imager optics

Light source: Aiming green LED, warm white illumination LED
Scan method: CMOS area sensor, 640 x 480 pixels, black and white
Scan rate: Up to 100 fps
Reading pitch angle: ± 65°
Reading skew angle: ± 65°
Reading tilt angle: 360°
Curvature: R>15 mm (EAN8), R>20 mm (EAN13)
Min. resolution at pcs 0.9: 0.1 mm / 4 mil
Min. pcs value: 0.2 (0.3 for UD model)
Field of view: Horizontal 38°, Vertical 28.9°
Depth of field at code 39:
55 - 128 mm (0.127 mm) / 2.16 - 5.04 in (5 mil)
54 - 239 mm (0.254 mm) / 2.13 - 9.41 in (10 mil)
71 - 435 mm (0.508 mm) / 2.79 - 17.13 in (20 mil)
Depth of field at QR code:
62 - 113 mm (0.169 mm) / 2.44 - 4.45 in (6.7 mil)
24 - 252 mm (0.381 mm) / 0.94 - 9.92 in (15 mil)

Supported symbologies

Barcode (1D): JAN/UPC/EAN incl. add on, Codabar/NW-7, Code 11, Code 39, Code 93, Code 128, GS1-128 (EAN-128), GS1 Databar (RSS), IATA, Industrial 2of5, Interleaved 2of5, ISBN-ISSN-ISMN, Matrix 2of5, MSI/Plessey, S-Code, Telepen, Tri-Optic, UK/Plessey
Postal code: Chinese Post, Intelligent Mail Barcode, Korean Postal Authority code, POSTNET

2D code: Aztec Code, Aztec Runes, Chinese Sensible code, Codablock F, Composite codes, Data matrix (ECC200), Passport MRZ (OCR-B), maxi Code (mode 2-5), MicroPDF417, MicroQR Code, PDF417, QR Code

Durability

Temperature in operation: -20 to 60 °C / -4 to 140 °F
Temperature in storage: -40 to 70 °C / -40 to 158 °F
Humidity in operation: 5 - 90% (non-condensing)
Humidity in storage: 5 - 90% (non-condensing)
Ambient light immunity: Fluorescent 10,000 lx max, Sunlight 100,000 lx max, Incandescent 10,000 lx max
Drop test: Packed in dummy case 1.8 m / 6 ft drop onto concrete surface
MTBF: 396,252 hours

Physical

Dimensions (WxHxD): Camera (CMOS) 24.6 x 6.0 x 13.6 mm / 0.97 x 0.24 x 0.53 in, PCB (decoder board) 25.1 x 3.2 x 20.8 mm / 0.99 x 0.13 x 0.82 in
Weight: Ca. 5.5 g / 0.19 oz

Regulatory & Safety

RoHS, IEC62471

Items

Sold separately: MEK-3100 development board (with power supply, RS232 cable, USB cable, PCBs)

OPTICON www.opticon.com

_MDI-4x50_04.2019

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION
CIVIL ACTION NO. 3:21-CV-00506-KDB-DCK

HONEYWELL INTERNATIONAL, INC.; METROLOGIC INSTRUMENTS, INC.; AND HAND HELD PRODUCTS, INC., **Plaintiffs,** **v.** **OPTO ELECTRONICS CO., LTD.,** **Defendant.**	**ORDER**

THIS MATTER is before the Court on Defendant OPTO Electronics Co., Ltd.'s ("OPTO") Objection to Magistrate Judge's Decision (Doc. No. 125), in which OPTO asks the Court to overrule a series of rulings on disputed discovery motions. (Doc. No. 115). For the reasons discussed below, the Court affirms the rulings and denies OPTO's Objection.

The filing of motions related to the discovery process, in which disputes are typically resolved among the parties, are relatively infrequent. Motions seeking a ruling on sixteen discrete discovery issues that require a hearing with a Magistrate Judge lasting over five hours are, to be sure, even more unusual. Discovery disputes that make it to a District Court Judge following a Magistrate Judge's thorough review and judgment are, in this Court's experience, truly rare.[1] However, a case in which a party asserts that the Magistrate Judge should be overruled on ***ten***

[1] This Court has only had two such matters in nearly four years on the bench.

discovery issues, not coincidently all of the substantive rulings by the Magistrate Judge that did not go in its favor,[2] is perhaps unprecedented. OPTO's objections arise in the unremarkable context of the adjudication of well-established discovery rules to partially disputed factual circumstances. So, it is unlikely that each of so many rulings are "clearly erroneous" or "contrary to law," which is the governing standard. Rather, it appears to the Court that OPTO simply seeks a fresh bite at the apple, hoping that this Court will exercise its judgment differently. OPTO has now received that second bite, but it will taste no better than its first. After an independent review of all these issues – with due regard for its appellate role – the Court finds that the Magistrate Judge's decisions should be affirmed.[3,4]

I. LEGAL STANDARD

A district court judge may designate a magistrate judge to hear and determine any pretrial matter pending before the court, including discovery disputes. See 28 U.S.C. § 636(b)(1)(A); *Mason v. Health Mgmt. Assocs. LLC*, No. 3:10-CV-472-KDB, 2020 WL 7186759, at *2 (W.D.N.C. Dec. 7, 2020). Rule 72(a) of the Federal Rules of Civil Procedure permits a party to submit objections to a magistrate judge's ruling on such non-dispositive matters within 14 days after being served with a copy of the order. Fed. R. Civ. P. 72(a). When a party timely objects to a magistrate judge's ruling on a non-dispositive discovery issue, the district court will modify or set aside any part of the order only if it is "clearly erroneous or is contrary to law." *Id*. Under the clearly erroneous standard, the reviewing court does not ask whether a finding is "the best or only

[2] Magistrate Judge Keesler ruled in OPTO's favor on five of the sixteen issues. On the lone "losing" issue on which OPTO did not object, OPTO was merely required to produce "a relatively simple chart." *See* Doc. No. 115 at 3.
[3] The Court also notes with dissatisfaction the personal sniping and apparent lack of cooperation among counsel that has undoubtedly contributed to these disputes, multiplied the costs of this litigation and abundantly seasons the Parties' briefing of the merits.
[4] The Court will defer ruling on Issues 6 and 8 as described below.

conclusion permissible based on the evidence." *In re Subpoena of Am. Nurses Ass'n*, No. 08-CV-0378, 2013 WL 5741242, at *1 (D. Md. Aug. 8, 2013) (quoting *Huggins v. Prince George's Cty.*, 750 F.Supp.2d 549, 559 (D. Md. 2010)). Rather, "[a] finding is 'clearly erroneous' when although there is evidence to support it, the reviewing court on the entire evidence is left with the definite and firm conviction that a mistake has been committed."[5] *United States v. U.S. Gypsum Co.*, 333 U.S. 364, 395 (1948); *see also Walton v. Johnson*, 440 F.3d 160, 173-74 (4th Cir. 2006).

"An order is 'contrary to law' where it fails to apply or misapplies relevant statutes, case law or rules of procedure." *See Meineke Car Care Centers, Inc. v. RLB Holdings, LLC*, 2011 WL 13217997, at *1 (W.D.N.C. Sept. 30, 2011) (quotations omitted); *Winthrop Resources Corp. v. Commscope, Inc. of North Carolina*, No. 5:11-CV-172, 2014 WL 5810457, at *1 (W.D.N.C. Nov. 7, 2014). "The 'contrary to law' standard ordinarily suggests a plenary review of legal determinations, but many courts have noted that decisions of a magistrate judge concerning discovery disputes ... should be afforded 'great deference.'" *Stone v. Trump*, 356 F. Supp. 3d 505, 511 (D. Md. 2018), *amended on reconsideration*, 402 F. Supp. 3d 153 (D. Md. 2019) (internal quotations and citations omitted); *see also Neighborhood Dev. Collaborative v. Murphy*, 233 F.R.D. 436, 438 (D. Md. 2005) (stating that "[a] district court owes substantial deference to a magistrate judge in considering a magistrate judge's ruling on a non-dispositive motion"); 12 Charles Allen Wright, Arthur R. Miller & Richard L. Marcus, Federal Practice & Procedure §

[5] In a only slightly different context, the Fourth Circuit has described "clearly erroneous" as not being "just maybe or probably wrong; it must ... strike us as wrong with the force of a five-week-old, unrefrigerated dead fish." *TFWS, Inc. v. Franchot*, 572 F.3d 186, 194 (4th Cir. 2009) (quoting *Bellsouth Telesensor v. Info. Sys. & Networks Corp.*, 1995 WL 520978, *5 n. 6 (4th Cir.1995). It must be "dead wrong." *Id*.

3069 (2d ed. 1997) (observing that altering a magistrate judge's nondispositive orders is extremely difficult to justify); *Cullen v. Hall Auto., LLC*, No. 2:21CV47, 2022 WL 1262549, at *1 (E.D. Va. Apr. 28, 2022) (same). "In light of the broad discretion given to a magistrate judge in the resolution of nondispositive discovery disputes, the court should only overrule a magistrate judge's determination if this discretion is abused." *Patrick v. PHH Mortg. Corp*., 298 F.R.D. 333, 336 (N.D.W. Va. 2014) (quoting *Shoop v. Hott*, 2010 WL 5067567, *2 (N.D.W. Va. Dec. 6, 2010)). Importantly, "it is not the function of objections to discovery rulings to allow wholesale relitigation of issues resolved by the magistrate judge." *Buchanan v. Consol. Stores Corp*., 206 F.R.D. 123, 124 (D. Md. 2002).

II. FACTS AND PROCEDURAL HISTORY

Plaintiffs (collectively, "Honeywell") and OPTO, a Japanese company, are competitors in the market for bar code scanning equipment and technology. In 2020, the Parties purported to settle extensive patent litigation at the U.S. International Trade Commission and in the United States District Court for the District of Delaware through a patent licensing agreement (the "Agreement"). In very brief summary, Honeywell claims in this action that OPTO has breached the Agreement by failing to pay royalties on certain alleged "2D" scanning products (which OPTO denies) and OPTO has filed counterclaims for unfair trade practices and patent misuse, alleging that Honeywell is using the Agreement to unlawfully seek royalties on products for which they do not have patent protection (which Honeywell denies).

The discovery efforts in this case have been extensive[6] and have engendered numerous disputes. On September 19, 2022, the Court held a discovery conference with counsel, which

[6] Based on the Parties' filing of cross-motions for Summary Judgment, one might be led to think broad discovery would be unnecessary. In their summary judgment motions, they each urge the

resulted in more motions. *See* Doc. Nos. 48, 49, 53, 54, 76. On September 30, 2022, the discovery period expired. On November 7, 2022, the District Judge then presiding referred the cited motions and others to Magistrate Judge David Keesler, Doc. No. 69, who eventually ordered the Parties to meet and confer and submit two Joint Status Reports describing the sixteen discovery disputes along with the Parties' respective positions, in advance of a discovery hearing. *See* Doc. Nos. 93, 111, 112, 114.

On January 26, 2023, Judge Graham C. Mullen recused himself from the case due to a conflict of interest and the matter was reassigned to Judge Kenneth D. Bell. On February 15, 2023, Judge Keesler held the discovery hearing, which lasted more than five hours. During the hearing, the Parties and the Court fully explored all the pending issues, and Judge Keesler provided the Parties with a forecast of his written decision. The next day, Judge Keesler entered an Order, Doc. No. 115, (the "Keesler Order") granting-in-part and denying-in-part the Parties' motions. The Keesler Order resolved Issues 1, 3, 4, 6, 8, 9, 11, 13, 14, 15, and 16 in favor of Honeywell and the remainder in favor of OPTO. On March 2, 2023, OPTO filed its Objection, Doc. 125, to all of the issues resolved against it, with the exception of Issue 11, which required only that OPTO produce a "relatively simple chart." *See* Doc. No. 115 at 3.

III. DISCUSSION

Court with equal ardor to find that the core dispute in the case – identifying the products on which royalties must be paid under the Agreement – must be answered in their favor based only on the plain "unambiguous" language of the Agreement.

As noted above, OPTO has raised objections to ten different discovery rulings by the Magistrate Judge. While each will be discussed briefly below, the objections relate to the familiar three issues on which most discovery disputes turn: the relevance of the requested documents or testimony, the burden of production, and the costs of the discovery.[7]

Generally speaking, parties are entitled to discovery regarding any nonprivileged matter that is relevant to any claim or defense. *See* Fed. R. Civ. P. 26(b)(1). Relevant information need not be admissible at the trial to be discoverable. *Id.* Where a party fails to respond to an interrogatory or a request for production of documents, the party seeking discovery may move for an order compelling an answer to the interrogatories or the production of documents responsive to the request. Fed. R. Civ. P. 37(a)(3)(B). The party resisting discovery bears the burden of establishing the legitimacy of its objections. *Eramo v. Rolling Stone LLC*, 314 F.R.D. 205, 209 (W.D. Va. 2016) ("[T]he party or person resisting discovery, not the party moving to compel discovery, bears the burden of persuasion." (quoting *Kinetic Concepts, Inc. v. ConvaTec Inc.*, 268 F.R.D. 226, 243 (M.D.N.C. 2010))).

Thus, the rules of discovery are to be accorded broad and liberal construction. *See Herbert v. Lando*, 441 U.S. 153, 177 (1979) and *Hickman v. Taylor*, 329 U.S. 495, 507(1947). Further, whether to grant or deny a motion to compel discovery is generally left within a district court's broad discretion. *See Lone Star Steakhouse & Saloon, Inc. v. Alpha of Va., Inc.*, 43 F.3d 922, 929 (4th Cir. 1995) (denial of motions to compel reviewed on appeal for abuse of discretion); *Erdmann*

[7] The Court notes that it disagrees with Honeywell's suggestion that the Court should find meaningful the disparity between the *number* of documents produced by the two sides. Courts must address each discovery request on its own merits, regardless of the running total score, which may be influenced by many factors, including the size of the respective companies, the number of record keepers or witnesses and the manner in which the relevant issues impact the parties. "Equal" is not necessarily the same as "Equitable."

v. Preferred Research Inc., 852 F.2d 788, 792 (4th Cir. 1988) (noting District Court's substantial discretion in resolving motions to compel). Rule 37(d) of the Federal Rules of Civil Procedure gives the district court discretion to impose sanctions for a party's failure to comply with its discovery orders. *Mut. Fed. Sav. & Loan Ass'n v. Richards & Assocs., Inc.*, 872 F.2d 88, 92 (4th Cir. 1989). And, as described in detail above, a District Court reviews a Magistrate Judge's order granting a motion to compel under Fed. R. Civ. P. 72(a), which provides that a District Court may reverse such a ruling only if it is "clearly erroneous or contrary to law." Fed. R. Civ. Pro. 72(a).

Judge Keesler's Order, which covers sixteen discovery issues, was the culmination of sixteen briefs (totaling over 200 pages), two joint status reports, and a discovery conference that lasted over five hours. *See* Doc. No. 122. However, OPTO complains that because Judge Keesler did not state his factual findings or legal conclusions explicitly in the order (for the most part merely ruling one way or the other on each issue), this Court cannot meaningfully review the Keesler Order under the governing "clearly erroneous or contrary to law" standard. The Court disagrees, in part. While it is true that, in the absence of a ruling from Judge Keesler describing / explaining his reasoning (even summarily), it is more difficult for the Court to know if the rulings rested on "clearly erroneous" factual determinations or legal analysis which is contrary to law, the extensive hearing transcript and the circumstances of the various issues make the grounds of Judge Keesler's decisions fairly easy to discern. In any event, as reflected below, the Court has independently reviewed these issues to reach a proper result on the merits, with due regard for its normal "appellate" role in reviewing a Magistrate Judge's non-dispositive discovery rulings. *See Duke Energy Carolinas, LLC v. NTE Carolinas II, LLC*, No. 319CV00515KDBDSC, 2021 WL 5826786, at *1 (W.D.N.C. Dec. 8, 2021).

Issue 1: Production of OPTO's Non-Privileged Analysis of Honeywell's Patents

The first issue is whether Judge Keesler properly ordered OPTO to produce its non-privileged analysis of Honeywell's patents. There is no dispute that the information sought to be produced is relevant. However, the Parties disagree on the practical scope of the request, with Honeywell representing that the request spans only 20-25 documents that can be readily identified and produced. OPTO in turn claims that it will need to review more than 100,000 pages of documents to respond to the request. The Court finds that OPTO has exaggerated its burden, so long as it focuses on producing the relatively few documents Honeywell has identified. Thus, the Magistrate Judge's ruling in favor of Honeywell is neither clearly erroneous nor contrary to law, and it will be affirmed.

Issue 3: Production of OPTO's Area-Imager-Based Source Code

The Court finds that OPTO's "Area-Imager-Based" source code is relevant within the broad scope of permissible discovery[8] and is not overly burdensome to produce. Therefore, the Magistrate Judge's ruling requiring the production of this source code is neither clearly erroneous nor contrary to law. So, it will be affirmed.

Issue 4: Deposition of Mr. Kurokawa

In response to Honeywell's noticed Rule 30(b)(6) deposition, OPTO designated Mr. Masaki Kurokawa—a Japanese citizen—as its corporate designee on technical issues, including the at-issue products' functionality and source code. The Parties arranged and Mr. Kurokawa appeared for his deposition in Osaka, Japan. Because of regrettable gamesmanship and posturing on both sides, his deposition did not go forward. However, the Court does not find that

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[8] By its discovery rulings the Court does not reach nor express any view as to the ultimate relevance or admissibility of the information ordered to be produced. Such determinations, as to all the information and testimony ordered here, will be made in the future as required.

Honeywell's conduct, while certainly not to be encouraged, should cause it to forfeit the opportunity to depose OPTO on the designated topics. Thus, to the extent that OPTO continues to designate Mr. Kurokawa as its corporate representative on the 30(b)(6) topics on which he was prepared to testify, the Court affirms the Magistrate Judge's decision that Honeywell be granted permission to depose him (or a substitute designee) in Charlotte, North Carolina,[9] unless otherwise agreed among the Parties.

Issue 6: **Attorney Communications and Documents Related to OPTO's Independent Auditor's Statements About this Litigation**

Honeywell seeks documents related to a litigation loss contingency (in the amount of Honeywell's litigation demand of $5.3 million), which was included in one of OPTO's public audits. Specifically, Honeywell seeks the following:

> [T]he public audit report specifically identifies several categories of documents the auditor relied on: (1) the complaint, the documents that form the basis of the lawsuit, and records of consultations with attorneys; (2) Board of Director meetings and other documents to examine the appropriateness of estimated amounts; (3) the views of legal counsel; and (4) the amount of the provision for litigation losses was reviewed by comparison and the like against the evidentiary documents.

According to OPTO, Honeywell has the public audit report along with all non-privileged communications with the auditors. However, it objects to producing attorney prepared evaluations of the case, which it contends are privileged. *See United States v. Deloitte LLP*, 610 F.3d 129, 143 (D.C. Cir. 2010) (finding that documents need not be produced where party has not proffered any good reason for wanting the documents other than its desire to know what the opposing party's

---

[9] As did the Magistrate Judge, the Court finds that the selection of a location for the depositions of OPTO's Japanese witnesses is a choice among inconvenient options. However, at this stage of the proceedings, the cost, expense and delay of ordering the taking of further depositions in Japan is not warranted. Thus, the depositions will be conducted in Charlotte, North Carolina, which is within the designated forum for any disputes arising out of the Agreement (the "appropriate state or federal courts of the State of North Carolina").

counsel thought about the case). In response, Honeywell relies in part on the earlier found relevance and lack of privilege associated with attorney communications related to the independent sales audit that was conducted under the Agreement.

As that sales audit will be considered during the summary judgment hearing in this matter, the Court will defer ruling on this issue until at or after that hearing.

Issue 8: The Deposition of Mr. Tanaka

OPTO designated Mr. Tanaka as a 30(b)(6) deponent to testify as to the corporation's knowledge of the Agreement and the underlying litigations. Thus, his deposition is tied to the issue of the production of additional information with respect to the litigation loss contingency described in Issue No. 6. *See* Doc. No. 149 at 14. The Court will also defer ruling on Issue 8 until it resolves Issue 6.

Issue 9: The Deposition of Mr. Kamio

Mr. Kamio is the Vice President of OPTO Electronics and the President of OPTO's United States subsidiary, Opticon Inc. Honeywell contends that Mr. Kamio has knowledge of relevant issues, including: (1) OPTO's decision to remove certain functionalities from its products; (2) the Agreement and the provisions in dispute in this litigation; and (3) OPTO's use of Honeywell's patents. The Court will affirm the Magistrate Judge's decision to permit Honeywell to depose Mr. Kamio in Charlotte as neither "clearly erroneous" or "contrary to law."

Issue 13: Attorney Communications and Attorney Work Product Related to Honeywell's Audit of OPTO's Worldwide Sales

OPTO seeks production of Honeywell's pre- and post-litigation communications with its attorneys as well as its attorneys' internal communications and both fact and opinion work product that refer or relate to the audit of OPTO's sales data. The Court declines to accept OPTO's position that the "crime-fraud exception" or other evidence justifies production of these privileged

documents. Accordingly, the Court will affirm the Magistrate Judge's decision to deny this request.

Issue 14: Deposition of Mr. Pleune

OPTO seeks the deposition of Alston & Bird attorney Benjamin Pleune, who is among the litigation counsel representing Honeywell. OPTO intends to question Mr. Pleune related to Honeywell's communications with the audit of OPTO's sales discussed above. The Court finds that Judge Keesler's conclusion that OPTO has not met the high bar for conducting a deposition of trial counsel is neither "clearly erroneous" or "contrary to law." *See Rex Venture Group, LLC v. Kaplan*, No. 3:14CV352, 2017 WL 9802760 (W.D.N.C. Sept. 8, 2017) (citing *Shelton v. Am. Motors Corp.*, 805 F.2d 1323, 1327 (8th Cir. 1986)); Doc. No. 115 at 4. Therefore, the Magistrate Judge's decision to deny this request will be affirmed.[10]

Issue 15: Deposition of Mr. Stevens

OPTO seeks the deposition of Mr. Scott Stevens because he was Honeywell's lead counsel in the ITC Investigation, the settlement of which led to the claims here. More specifically, OPTO wants to depose Mr. Stevens on certain patent claim charts that Honeywell produced during the ITC Investigation. As with Mr. Pleune, the Court finds that Judge Keesler's conclusion that OPTO has not established sufficient grounds for deposing one of Honeywell's lawyers is neither "clearly erroneous" or "contrary to law." However, as with the audit related communications discussed above, if the patent claim charts are admitted into evidence then Honeywell will not be permitted to offer Mr. Stevens as a witness, having objected to allowing him to be deposed.

[10] To be clear, in so far as the audit of OPTO's sales is relevant to this action, OPTO may, depending on the evidence, be permitted to introduce documents or testimony which it contends casts doubt on the independence of the audit. In the event that OPTO is permitted to do so, Honeywell will not be permitted to offer Mr. Pleune as a responsive witness, having declined to make him available for a deposition on that (or any related) issue.

Issue 16: OPTO's Motion for Reimbursement of Expenses and Protective Order Related to the Deposition of Mr. Kurokawa

The Court affirms the Magistrate Judge's decision to deny OPTO's request for the award of its costs related to the failure of the Parties to conduct Mr. Kurokawa's deposition. As discussed above, the Court finds that both Parties share blame for that unfortunate fiasco. Each side should therefore bear its own costs. However, if the Court in the future determines that either party is pursuing discovery primarily for the purposes of increasing the expense to the other party or otherwise acting outside the bounds of good faith discovery on the merits, it will not hesitate to award costs.[11]

IV. ORDER

NOW THEREFORE IT IS ORDERED THAT:

Defendant's Objection to Magistrate Judge's Decision (Doc. No. 125) is **DENIED,** and the Order Granting in Part and Denying in Part Discovery Disputes (Doc. No. 115) is **AFFIRMED** to the extent described above.

SO ORDERED ADJUDGED AND DECREED.

Signed: March 21, 2023

Kenneth D. Bell
United States District Judge

[11] The Parties should also note that the Court will similarly not hesitate to impose costs on any party that files an unsuccessful motion accusing the opposing party of such conduct.

EXHIBIT A

OPTICON

Cabled Scanners

L-22X

2D CMOS Imager

Featuring the perfect combination of performance, durability and reliability, the Opticon L-22X is a 2D CMOS imager handheld cabled scanner. It has an impressive design ensuring a comfortable grip and it looks great on the counter.

Highlights

- Sophisticated ergonomic design with an excellent price-to-performance ratio
- High speed 2D CMOS imager
- Rapidly scans and decodes a wide variety of 1D or 2D barcodes
- Custom configuration capabilities including multi-read
- Enhanced motion tolerance
- Improved scanning of curved, wide and poorly printed barcodes
- Durable – survives 1.5 meter drop to concrete
- IP42 rating against dust and moisture
- Trigger modes: manual, auto-trigger and stand detection
- Communication interface: USB or RS232
- Available in black or white
- Stand included
- Backed by a two year warranty

L-22X

Product Specifications

Operation
CPU: ARM-Cortex-A7

Operating indicators
Visual: 3 color LED
Non-visual: buzzer, vibrating motor (optional)

Operating keys
Entry options: 1 scan key

Communication
RS232C: DB9 pin with external power supply
USB: ver. 2.0, HID/VCP, USB-A connector

Power
Voltage requirement: 5V ± 10% (RS232C and USBCOM)
Current consumption: Typ. 340 mA (USB), 325 mA (RS-232)

2D Imager optics
Light source: Aiming green LED, warm white illumination LED
Scan method: CMOS area sensor, 640 x 480 pixels
Scan rate: Up to 100 fps
Trigger mode: Manual, auto-trigger, stand detection
Reading pitch angle: ± 65º
Reading skew angle: ± 65º
Reading tilt angle: 360º
Curvature: R≥20 mm (12-digit UPC)
Min. resolution at PCS 0.9: 0.1 mm
Field of view: Horizontal 38,0º, Vertical 26,4º
Min. PCS value: 0.2
Depth of field at code 39:
11 - 57 mm (0.127 mm) / 0.233 - 2.244 in (5 mil)
9 - 156 mm (0.254 mm) / 0.354 - 6.141 in (10 mil)
31 - 318 mm (0.508 mm) / 1.221 - 12.519 in (20 mil)
Depth of field at Code 128:
24 - 112 mm (0.2 mm) / 0.944 - 4.409 in (7.9 mil)
Depth of field at UPC:
9 - 195 mm (0.33 mm) / 0.354 - 7.667 in (13 mil)
Depth of field at PDF417:
4 - 76 mm (0.169 mm) / 0.157 - 2.992 in (6.7 mil)
0 - 130 mm (0.254 mm) / 0 - 5.118 in (10 mil)
Depth og field at QR Code:
20 - 44 mm (0.212 mm) / 0.787 - 1.7323 in (8.3 mil)
0 - 161 mm (0.381 mm) / 0 - 6.339 in (15 mil)
Depth of field at DataMatrix:
22 - 48 mm (0.169 mm) / 0.866 - 1.89 in (6.7 mil)
2 - 96 mm (0.254 mm) / 0.079 - 3.779 in (10 mil)

Supported symbologies
Barcode (1D): UPC-A, UPC-E, UPC-E1, UPC-A Add-on, UPC-E Add-on, EAN-13, EAN-8, EAN-13 Add-on/EAN-8 Add-on, JAN-8, JAN-13, Code 39, Tri-Optic, Codabar, Industrial 2 of 5, Interleaved 2 of 5, S-code, Code 93, Code 128, GS1-128, IATA, MSI/Plessey, UK/Plessey, Telepen, Code 11, Matrix 2 of 5
Postal code: Chinese Post Matrix 2of5, Korean Postal Authority code, Japanese Postal,Intelligent Mail Barcode, POSTNET, PLANET, Netherlands KIX Code, Australian Postal, UK Postal, 4-State Mailmark Barcode
2D code: PDF417, MicroPDF417, Codablock F, QR Code, Micro QR Code, Data Matrix (ECC 200), Maxi Code (Modes 2 to 5), Aztec Code, Chinese Sensible Code, OCR-B

Durability
Temperature in operation: -5 to 50 ºC / 23 to 122 ºF
Temperature in storage: -30 to 60 ºC / 22 to 140 ºF
Humidity in operation: 5% to 90% (non-condensing)
Humidity in storage: 5% to 90% (non-condensing)
Ambient light immunity: Fluorescent 10,000 lx max, direct sun 100,000 lx
Max drop test: 1.8 m / 6 ft drop onto concrete surface
Vibration test: 10 - 100Hz with 2G for 1 hour
Protection rate: IP42

Physical
Dimensions (W x H x D): 165.3 x 62.2 x 31.4 mm / 6.51 x 2.45 x 1.24 in
Cable length: 2.0 m
Weight body: Ca. 77 g / 2.7 oz (excl. cable)
Dimensions stand (W x H x D): 98.9 x 130.5 x 173.8 mm / 3.89 x 5.14 x 6.84 in
Weight stand: Ca. 120 g / 4.2 oz (excl. cable)
Case: ABS/PC, Black or White

Regulatory & safety
Product compliance: CE, FCC, VCCI Class B, RoHS, IEC61000-4-2, EN55032, EN55024 (EN61000-6-1) Class B

Items
Enclosed: Stand

Models
Interface versions: USB, RS232 cable

OPTICON www.opticon.com

_L-22X_04.2019

EXHIBIT B

US010140490B2

(12) **United States Patent**
Kubo et al.

(10) **Patent No.: US 10,140,490 B2**
(45) **Date of Patent: Nov. 27, 2018**

(54) **MODULE FOR OPTICAL INFORMATION READER**

(71) Applicant: **OPTOELECTRONICS CO., LTD.**, Warabi-shi, Saitama (JP)

(72) Inventors: **Wataru Kubo**, Warabi (JP); **Satoshi Komi**, Warabi (JP)

(73) Assignee: **OPTOELECTRONICS CO., LTD.**, Warabi-shi (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/049,691**

(22) Filed: **Feb. 22, 2016**

(65) **Prior Publication Data**

US 2016/0253536 A1 Sep. 1, 2016

Related U.S. Application Data

(60) Provisional application No. 62/121,312, filed on Feb. 26, 2015.

(30) **Foreign Application Priority Data**

Oct. 6, 2015 (JP) 2015-198590

(51) **Int. Cl.**
G06K 7/10 (2006.01)
G02B 26/10 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G06K 7/10831*** (2013.01); ***G02B 7/025*** (2013.01); ***G02B 7/04*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC G02B 26/105; G02B 7/023; G02B 7/025; G02B 27/30; G02B 27/62; G06K 7/1098; G06K 7/10831
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,918,702 A * 4/1990 Kimura G02B 6/4204 372/101
5,490,158 A * 2/1996 Mogi B41J 2/471 372/36
(Continued)

FOREIGN PATENT DOCUMENTS

JP 05022530 A * 1/1993
JP 2000028888 A * 1/2000
(Continued)

OTHER PUBLICATIONS

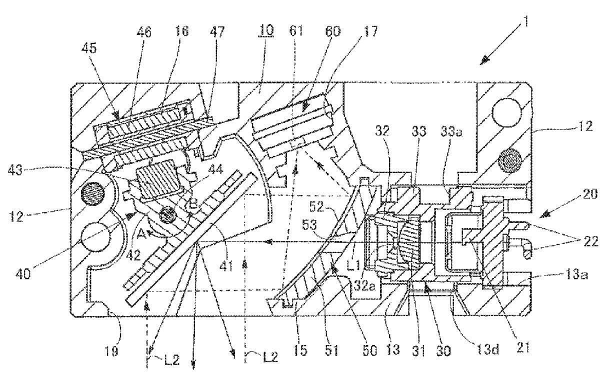
English Translation of JP2010117510; retrieved Jan. 23, 2017.*
(Continued)

Primary Examiner — Christopher Stanford
(74) *Attorney, Agent, or Firm* — Westerman, Hattori, Daniels & Adrian, LLP

(57) **ABSTRACT**

A collimator lens unit in which an aperture limit stop formation member and a collimator lens are integrally disposed in a cylindrical member is inserted in a lens-barrel hole of the module casing so as to be reciprocatable in an optical axis direction, and a light-emitting unit is fixed in the lens-barrel hole, with an optical axis of a light source aligned with an optical axis of the collimator lens. A long hole through which an adjust pin is penetrated so as to be reciprocatable in the optical axis direction is formed in a peripheral sidewall of the lens-barrel hole, and a fitting portion in which the adjust pin is fit is formed in an outer peripheral surface of the cylindrical member. On an inner peripheral surface of the lens-barrel hole, at a position opposed to the fitting portion, bearing portions in contact with the outer peripheral surface of the cylindrical member are formed.

8 Claims, 6 Drawing Sheets



(51) **Int. Cl.**
G02B 27/30 (2006.01)
G02B 7/04 (2006.01)
G02B 7/02 (2006.01)

(52) **U.S. Cl.**
CPC ***G02B 26/105*** (2013.01); ***G02B 27/30*** (2013.01); ***G06K 7/1098*** (2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,178,016	B1 *	1/2001	Ashe	H04N 1/03 358/487
6,410,904	B1	6/2002	Ito et al.	
6,661,588	B1 *	12/2003	Huang	G02B 7/026 359/819
7,206,109	B2	4/2007	Hayakawa et al.	
2004/0109243	A1 *	6/2004	Orimo	G02B 7/023 359/819
2005/0040324	A1 *	2/2005	Kobayashi	G02B 7/025 250/234
2006/0204234	A1 *	9/2006	Kawai	G02B 7/10 396/72
2007/0047110	A1 *	3/2007	Matsushima	G02B 7/025 359/819
2011/0013901	A1 *	1/2011	Utsugi	G02B 7/026 396/529

FOREIGN PATENT DOCUMENTS

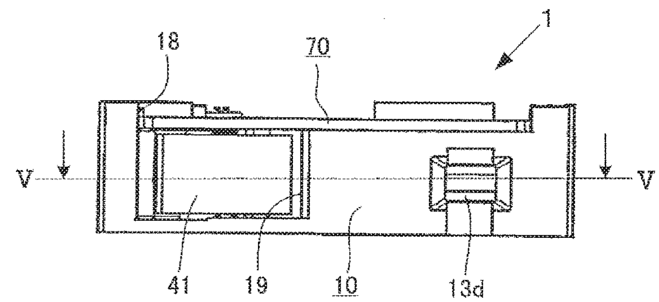
JP	2001-215425	A		8/2001
JP	2003-76942	A		3/2003
JP	2006138914	A	*	6/2006
JP	2010-117510	A		5/2010
WO	03/019463	A1		3/2003

OTHER PUBLICATIONS

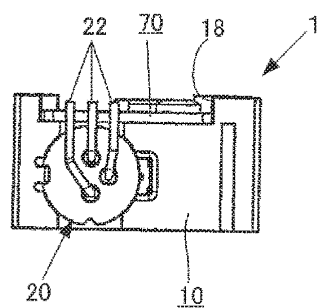
Certificate of Patent dated May 27, 2016, issued in counterpart Japanese Patent Application No. 2015-198590. (1 page).
English translation of Notification of Reasons for Refusal dated Feb. 23, 2016, issued in counterpart Japanese Patent Application No. 2015-198590 (3 pages).
Office Action dated Feb. 23, 2016, issued in counterpart Japanese Patent Application No. 2015-198590. (3 pages).

* cited by examiner

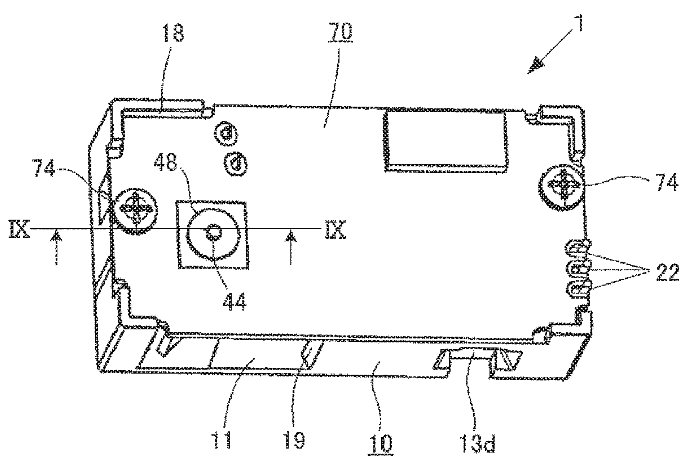
{Fig. 1}



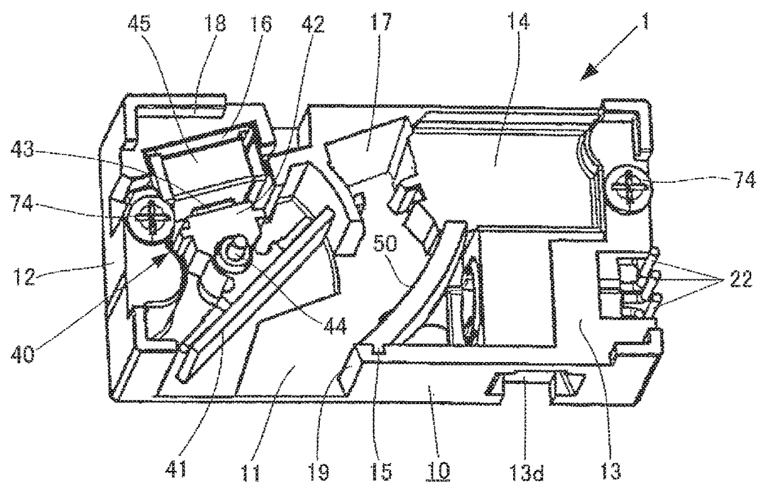
{Fig. 2}



{Fig. 3}



[Fig. 4]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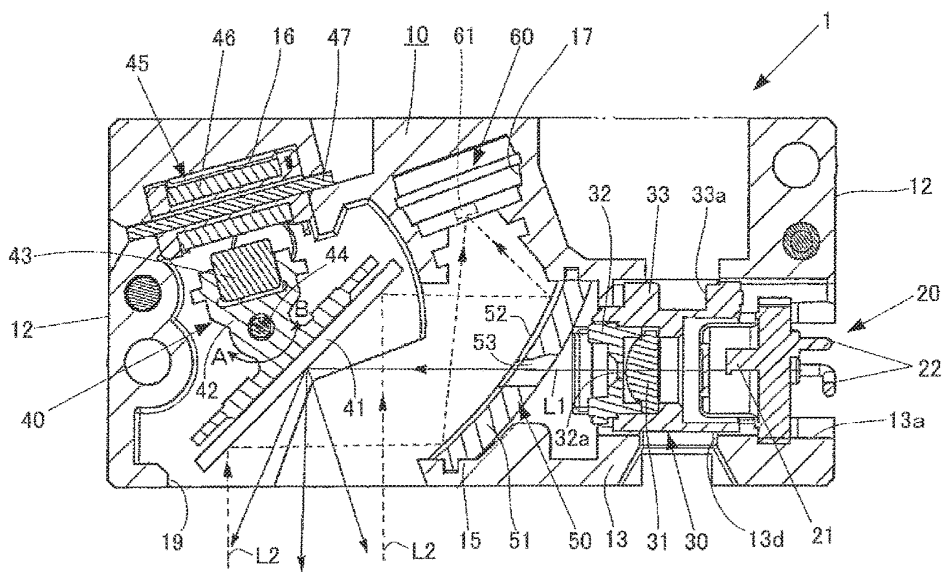
[Fig. 5]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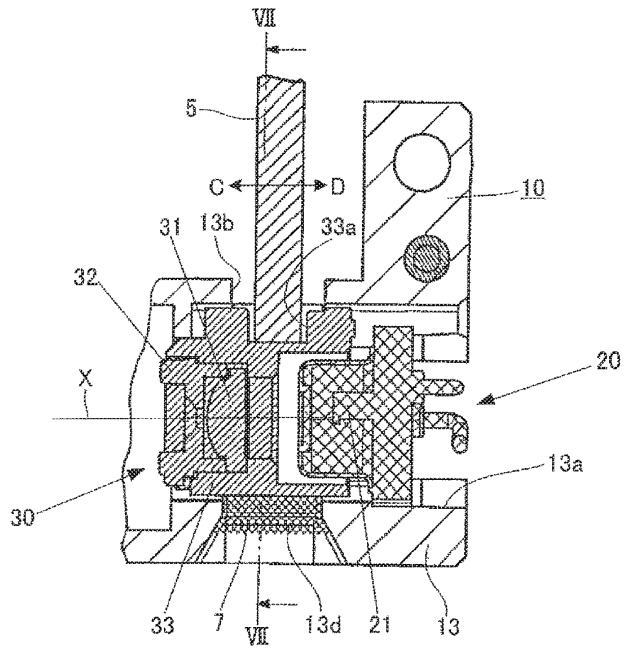
[Fig. 6]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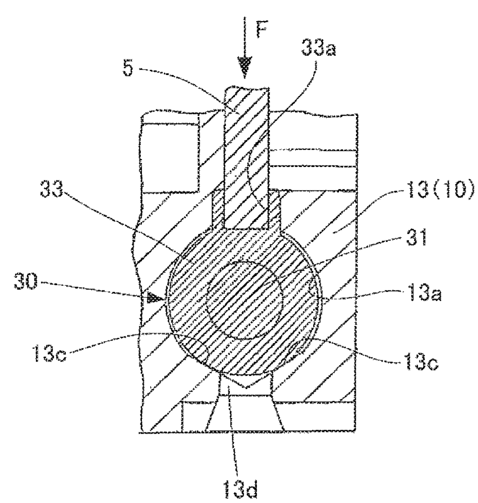
[Fig. 7]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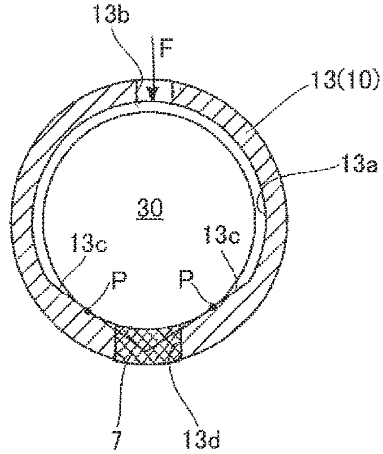
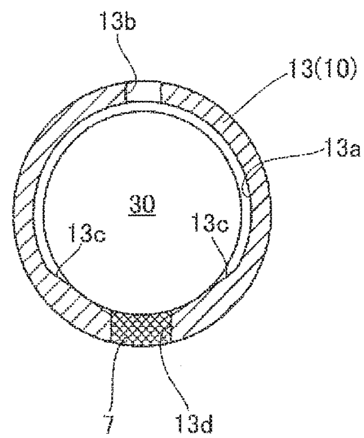
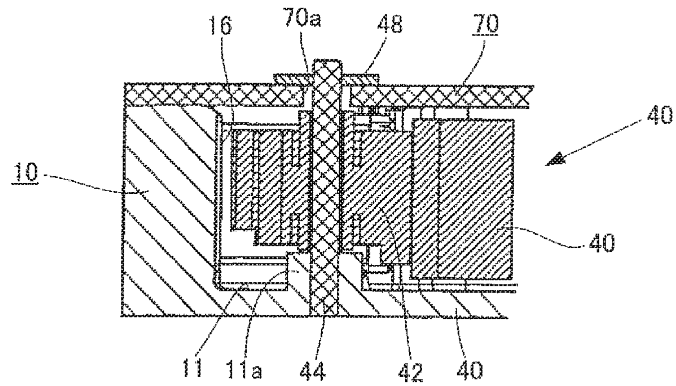
[Fig. 8A]



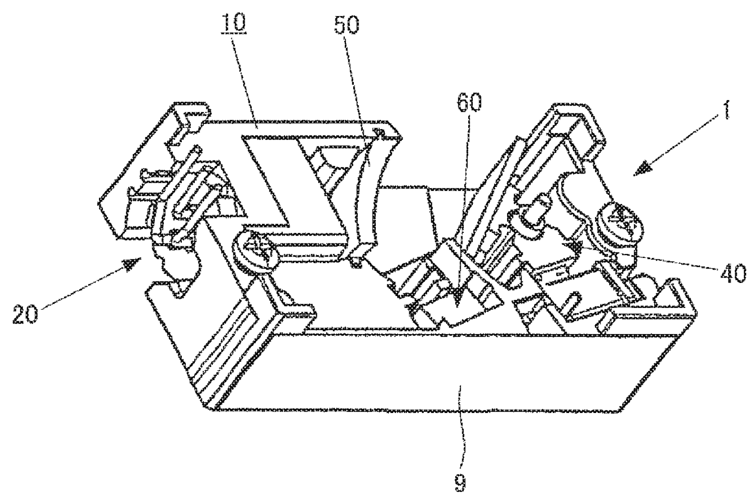
[Fig. 8B]



[Fig. 9]

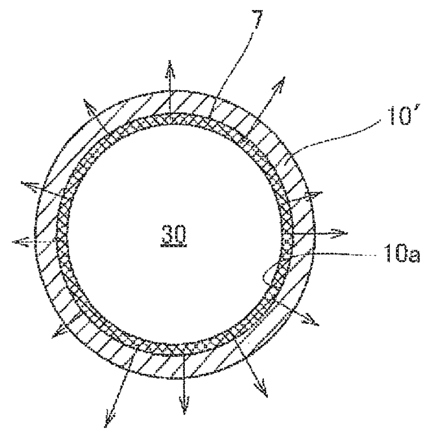


[Fig. 10]



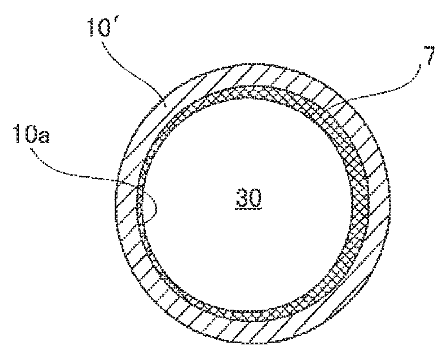
[Fig. 11A]

PRIOR ART



[Fig. 11B]

PRIOR ART



MODULE FOR OPTICAL INFORMATION READER

FIELD OF THE INVENTION

The invention relates to a module installed in an optical information reader for reading optical information of a bar code and the like.

BACKGROUND OF THE INVENTION

As an optical information reader, bar code readers which read optical information of bar codes, two-dimensional codes, and the like indicating information such as names and prices of products are used widely by the distribution industry and the retail industry.

The bar code readers are roughly classified into hand-held ones held by one hand when in use and stationary ones, and the hand-held ones further include a pen type, a touch type, and a light beam scanning type (laser type). Among these, an optical information reader being an object of the invention. is an optical information reader such as a hand-held bar code reader of the light beam scanning type.

A bar code reader of the light beam scanning type shapes light emitted by a light source such as a laser diode (semiconductor laser) into a beam, deflects the light beam by a mirror so that the light beam hits on a bar code, and while rotating or vibrating (swinging) the mirror, scans the bar code so that the light beam moves across the bar code.

Then, the reflected light from the bar code is condensed, is received by a light-receiving sensor, and is converted to an electrical signal. The electrical signal is coded after A/D conversion and the resultant is output as bar code read information. In the hand-held optical information reader of the light beam scanning type, its read engine part is required to be greatly reduced in size and weight.

Under such circumstances, there has come into use a module for an optical information reader in which the aforesaid light source, a collimator lens for shaping the light emitted by the light source into a beam, a vibration mirror and it's driver, a collector mirror or a condenser lens, a light-receiving sensor, a processing circuit for a detection signal of the light-receiving sensor, and so on are assembled in a common easing to be modularized, as described in, for example, PLT 1, 2, 3, and so on.

In such a module for an optical information reader, a light-emitting unit whose light source is, for example, a laser diode, the collimator lens for turning the light emitted by the light source into a parallel luminous flux, and a member having an aperture through which the parallel luminous flux exits as a thin beam need to be fixedly positioned in a lens barrel, with their optical axes aligned. Further, in order for the collimator lens to surely generate the light beam which is to be converged in the parallel light flux or at a finite distance, it is necessary to accurately adjust the distance between the light-emitting unit and the collimator lens (collimation adjustment or focus adjustment) so that a focal point of the collimator lens and a light-emitting point of the light-emitting unit have a predetermined positional relation.

Therefore, in a light beam generating part in the module for the optical information reader disclosed in the aforesaid PLT 1, 2, 3, in part of the module casing, a lens-barrel hole is provided, at whose leading end portion the aperture being an aperture limit stop for letting the light beam exit therethrough is formed and whose rear end portion is opened to be formed as a press-fitting portion where to press-fit the light-emitting unit. Then, the collimator lens is bonded and fixed at a position short of the aperture, at a leading end rear side portion of the lens-barrel hole, and the light-emitting unit is pressed into the press-fitting portion from the rear end portion, whereby they are positioned.

CITATION LIST

Patent Literature

{PTL 1} U.S. Pat. No. 7,206,109 B2
{PTL 2} WO 03/019463 A1
{PTL 3} JP 2003-76942 A

SUMMARY OF INVENTION

Technical Problem

Such a conventional module for an optical information reader had the following problems.

Since the light-emitting unit is pushed into the lens-barrel hole while being pressed, and for the collimation adjustment, it is moved in one direction (a direction which is an optical axis direction and in which it approaches the collimator lens), re-adjustment by returning it was not possible. Accordingly, when the light-emitting unit is pushed too much, this module becomes a defective product, resulting in worsened production yields.

Further, delicate adjustment on a micron level was not possible since the light-emitting unit is press-fit and thus frictional resistance is high, and there is a possibility that the collimator lens and the laser diode are tilted relatively to each other.

Object of the Invention

The invention was made in consideration of the above technical background, and has an object to make it possible to, in a module for an optical information reader, easily and delicately make collimation adjustment and focus adjustment in both directions of back and forth directions along an optical axis while preventing a collimator lens and a laser diode from being tilted relatively to each other, thereby greatly reducing the occurrence of defective products to enhance production yields.

Solution to Problem

A module for an optical information reader according to the invention is a module for an optical information reader in which a light-emitting unit having a light source such as a laser diode, a collimator lens, a vibration mirror for scanning, a collector mirror or a condenser lens, and a light-receiving sensor are disposed in a module casing to be modularized, and it is structured as follows in order to achieve the aforesaid object.

A collimator lens unit in which an aperture limit stop formation member and the collimator lens are integrally disposed in a cylindrical member is inserted in a lens-barrel hole of the module casing so as to be reciprocatable in an optical axis direction within a predetermined range, and the light-emitting unit is fixed to the module easing in the lens-barrel hole, with an optical axis of the light source aligned with an optical axis of the collimator lens.

Further, a long hole through which an adjust pin is penetrated so as to be reciprocatable in the optical axis direction within a predetermined range is formed in a peripheral sidewall of the lens-barrel hole of the module

casing, and a fitting portion in which a tip portion of the adjust pin penetrating through the long hole is fit is formed in an outer peripheral surface of the cylindrical member.

Furthermore, on an inner peripheral surface of the lens-barrel hole of the module casing, at or near a position opposed to the fitting portion, bearing portions in contact with the outer peripheral surface of the cylindrical member are formed at positions symmetrical with respect to the position in terms of an inner circumferential direction of the lens-barrel hole.

Preferably, the bearing portions form a V-shaped slope by two flat surfaces which, in a circumferential direction, are in point contact with the outer peripheral surface of the cylindrical member, and in an axial direction, are in line contact with the outer peripheral surface.

Preferably, an open-hole through which an adhesive for fixing the cylindrical member is tillable is formed in a middle region, of the V-shaped slope, which is not in contact with the outer peripheral surface of the cylindrical member.

The collimator lens unit may be structured such that the collimator lens and the aperture limit stop formation member are fixed to the cylindrical member.

The collimator lens unit may be structured such that the aperture limit stop formation member and the cylindrical member are integrally disposed on the collimator lens itself.

The collimator lens unit may be structured such that the collimator lens and the cylindrical member are integrally formed of the same material or different kinds of materials, and to the resultant formed body, the aperture limit stop formation member is fixed.

The module casing may be formed of resin. Desirably, the resin is reinforced resin in which carbon is dispersed.

Desirably, a metallic foil is affixed on an outer wall surface of the module casing made of the resin, at least near a portion where the light-receiving sensor is housed.

Advantageous Effects of Invention

In the module for the optical information reader according to the invention, the module casing is fixed to a jig, the tip portion of the adjust pin is passed through the long hole of the module casing to be inserted into the lens-barrel hole and is fit in the fitting portion of the cylindrical member or the cylindrical part of the collimator lens unit, and when the adjust pin is moved in the optical axis direction of the collimator lens by a linear movement mechanism of the jig, it is possible to move the collimator lens integrally with the cylindrical member or the cylindrical part to easily make collimation adjustment.

Further, the adjustment can be made while the collimator lens is moved in the both directions of the optical axis direction, that is, directions in which it approaches and separates from the light source, and therefore, if it is moved too much in one of the directions, the re-adjustment is possible by returning it. This can greatly reduce the occurrence of defective products to enhance production yields. Setting a movement pitch of the adjust pin fine can facilitate, even delicate and highly accurate adjustment.

Since it is possible for the adjust pin to move the cylindrical member or the cylindrical part of the collimator lens unit while pressing it against the bearing portions on the opposite side, the adjustment can be made without any deviation of the optical axis. Further, by reducing a contact area between the outer peripheral surface of the cylindrical member or the cylindrical part and the bearing portions, it is possible to move the cylindrical member or the cylindrical part smoothly with a relatively small force.

If the open-hole from which the adhesive can be filled is formed near the bearing portions, it is possible to fill the adhesive from the opening to fixedly bond the cylindrical member or the cylindrical part to the module casing after the collimation adjustment while pressing the cylindrical member or the cylindrical part against the bearing portions by the adjust pin, and thus adjustment deviation and optical axis deviation of the collimator lens are not liable to occur.

Forming the module casing of the resin having the heat dissipation property and the shielding property makes it possible to reduce weight as well as to reduce cost far more than forming it of metal. In addition, the heat dissipation property and the shielding property to a degree not practically problematic can also be obtained. Using the black resin such as the reinforced resin in which carbon is dispersed makes it possible to prevent the reflection of the light. If the shielding effect is not sufficient, by affixing the metallic foil on a necessary portion of the outer wall surface of the module casing, it is possible to enhance the shielding effect.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a front view of one embodiment of a module for an optical information reader according to the invention.

FIG. **2** is a right side view of the module for the optical information reader according to the same.

FIG. **3** is a perspective view of the module for the optical information reader according to the same seen from obliquely above.

FIG. **4** is a perspective view of the module for the optical information reader according to the same seen from the same direction as that in FIG. **3**, with a circuit board removed.

FIG. **5** is an enlarged sectional view taken along V-V line in FIG. **1**.

FIG. **6** is an enlarged partial sectional view illustrating a light beam generating part in FIG. **5** together with an adjust pin.

FIG. **7** is a partial sectional view taken along VII-VII line in FIG. **6**.

FIG. **8**A is a sectional view schematically illustrating a cross section similar to that in FIG. **7** to explain characteristics of collimation adjustment according to an embodiment of the invention.

FIG. **8**B is a sectional view illustrating the same in a state after an adhesive for fixing a collimator lens unit to a module casing is cured.

FIG. **9** is a sectional view taken along IX-IX line in FIG. **3**.

FIG. **10** is a perspective view illustrating an embodiment in which a metallic foil is affixed on an outer wall surface of the module casing to enhance a shielding effect, with the circuit board removed.

FIG. **11**A is a sectional view illustrating a bonding example being a reference example for comparison with the embodiment of the invention, which corresponds to FIG. **8**A before the adhesive is cured.

FIG. **11**B is a sectional view illustrating the same, which corresponds to FIG. **8**B after the adhesive is cured.

DETAILED DESCRIPTION

Hereinafter, modes for carrying out the invention will be described based on the drawings.

First, the entire structure of one embodiment of a module for an optical information reader according to the invention will be specifically described with reference to FIG. **1** to FIG. **5**.

FIG. **1** is a front view of the module for the optical information reader and FIG. **2** is a right side view thereof FIG. **3** is a perspective view of the module for the optical information reader seen from obliquely above, and FIG. **4** is a perspective view of the same seen from the same direction, with a circuit board removed. FIG. **5** is an enlarged sectional view taken along V-V line in FIG. **1**.

This module **1** for the optical information reader is a read engine installed in an optical information reader such as a bar code reader, and as illustrated in these drawings, it is composed of a module casing **10**; a light-emitting unit **20**, a collimator lens unit **30**, a vibration mirror driver **40**, a collector mirror **50** having a concave surface shape, and a light-receiving sensor **60** which are assembled in the module casing **10**; a circuit board **70** attached to an upper surface of the module casing **10**; and so on.

The module casing **10** has, for example, a size of 14 mm depth (D) 28 mm width (W), and 7.5 mm height (H) as its whole outer shape, but this is not restrictive. Since such a module casing is required to have a heat dissipation property and a shielding property, it has been conventionally formed by a die casting manufacturing method by using metal such as, for example, zinc called ZDC2 or a magnesium alloy called AZ91D. The module casing of the module for the optical information reader according to the invention may similarly be formed of metal by the die casting manufacturing method.

However, the module casing **10** in this embodiment is formed of resin higher in heat dissipation property (thermal conductivity) and shielding property (electric conductivity) than ordinary resin, for example, formed of black reinforced resin in which carbon is dispersed. As a specific example of the resin material, TCF1140 manufactured by Mitsubishi Engineering-Plastics Corporation is preferably used. Forming the module casing **10** of such resin can achieve a cost reduction and a great weight reduction, and to obtain a heat dissipation property and a shielding property high enough for practical application.

Further, this module casing **10** has a bottom surface portion **11**, a sidewall portion **12** surrounding its periphery, a light beam generating part housing part **13**, a LSI housing recessed part **14**, a collector mirror attachment part **15**, a vibration mirror driver attachment part **16**, a light-receiving unit attachment part **17**, a circuit board holding part **18**, and so on.

On the bottom surface portion **11** of the vibration mirror driver attachment part **16**, a boss **11***a* (refer to FIG. **9**) is formed, and a lower end portion of a support shaft **44** of a vibration mirror **41** is fit therein to be supported. A front face, of the sidewall portion **12**, corresponding to the vibration mirror driver attachment part **16** is opened to form an opening **19** for letting a light beam exit and incident.

As illustrated in FIG. **5**, the light-emitting unit **20** and the collimator lens unit **30** which form a light beam generating part are disposed in a lens-barrel hole **13***a* which is formed in the light beam generating part housing part **13** of the module casing **10** and which has a cylindrical inner peripheral surface.

The light-emitting unit **20** has a laser diode **21** as a light source, and is inserted to be fixed in the lens-barrel hole **13***a* from an opening of the sidewall portion **12** of the module casing **10** on the right side in FIG. **5**. As illustrated in FIG. **2** and so on, three terminals **22** of the laser diode **21** project to extend upward from a rear end surface of the light-emitting unit **20** and are connected to terminals of the board **70** side.

In the collimator lens unit **30**, a collimator lens **31** and an aperture limit stop formation member **32** in which an aperture **32***a* being an aperture limit stop is formed are integrally fixed in a cylindrical member **33** being a collimator lens barrel. The aperture limit stop formation member **32** is fixed to a front end portion of the cylindrical member **33** by an adhesive or the like, presses the collimator lens **31** against an inner periphery stepped portion of the cylindrical member **33** to fix it, and has the aperture **32***a* disposed just in front of the collimator lens **31**.

This collimator lens unit **30** is inserted in the lens-barrel hole **13***a* of the light beam generating part housing part **13** of the module casing **10** so as to be reciprocatable in an optical axis direction within a predetermined range. The aperture limit stop formation member **32** and the cylindrical member **33** can be formed of the same material as or has performance equivalent to that of the module casing **10** (polycarbonate containing 20% glass, aluminum, or the like). The light-emitting unit **20** is fixed to the module casing **10** in the lens-barrel hole **13***a* so as to partly enter the inside of the cylindrical member **33**, with an optical axis of the light source being aligned with an optical axis of the collimator lens **31**. Details of the collimator lens unit **30** and collimation adjustment will be described later.

As illustrated in FIG. **4** and FIG. **5**, the vibration mirror driver **40** is composed of: a vibration mirror **41** for light beam scanning made of metal, resin, or glass; a vibration mirror holding member **42** fixed to a front surface portion of the vibration mirror **41** and made of resin; a movable magnet (permanent magnet) **43** fixed to a rear surface side of the vibration mirror holding member **42**; the support shaft **44** in a pin shape supporting the vibration mirror holding member **42** so as to allow its rotation; and a coil unit **45** disposed to face and to be apart from and in parallel to the movable magnet **43**. In the coil unit **45**, a yoke **47** penetrates through a coil **46** in a direction perpendicular to a winding direction of the coil **46**.

These are attached to the vibration mirror driver attachment part **16** of the module casing **10**. Then, by an action of the movable magnet **43** and the coil unit **45**, the vibration mirror holding member **42** and the vibration mirror **41** fixed thereto are vibrated (swung) in a seesaw manner as indicated by the arrows A, B in FIG. **5**.

A collector mirror **50** having a concave surface shape is fixed in a tilting manner to the collector mirror attachment part **15** of the module casing **10** so as to face the vibration mirror **41** and the light-receiving sensor **60**. The collector mirror **50** has a reflective film **52** formed on a concave curved surface of a curved substrate **51** made of resin, and has a rectangular or circular through hole **53** formed at its center portion to allow the light beam to pass therethrough.

The light-receiving sensor **60** has a light-receiving element **61** such as a photodiode (PD), and is integrated with the circuit board **70** with its two terminals connected to the circuit board **70** illustrated in FIG. **3**. Accordingly, when the circuit board **70** is mounted on the circuit board holding part **18** of the module casing **10**, the light-receiving sensor **60** is inserted to the light-receiving sensor attachment part **17** to be disposed at a predetermined position.

On the circuit board **70**, a not-illustrated necessary wiring pattern is formed and various kinds of chip-shaped electronic components are attached, and on its rear surface side, a LSI (large-scale integrated circuit) playing a central role in signal processing and control is mounted.

Then, this circuit board **70** is fixedly attached to the upper surface of the module casing **10** with a plurality of screws **74**, and serves also as an upper cover of this module **1** for

the optical information reader. At this time, the LSI mounted on the rear surface is housed in the LSI housing recessed part **14** (FIG. **4**) of the module casing **10**. The LSI is prevented from being influenced by electromagnetic wave noise generated by other electronic devices, cellular phones, and so on since four surfaces of its outer periphery are surrounded by the resin with a high shielding property of the module casing **10**.

Functions of the module **1** for the optical information reader thus structured will be described by mainly using FIG. **5**.

A laser ray is generated as a result of the light emission of the laser diode **21** being the light source in the light-emitting unit **22**, this is turned into a luminous flux which is parallel or is converged at a desired distance by the collimator lens **31**, and the luminous flux is passed through the aperture **32***a* to be radiated as a laser beam L**1** indicated by the solid line.

This laser beam L**1** passes through the through hole **53** of the collector mirror **50** to reach the vibration mirror **41**, is reflected in a predetermined angular range whose center is 90°, due to the vibration of the vibration mirror **41**, and exits from the opening **19** to the outside. This laser beam irradiates a not-illustrated bar code symbol.

The bar code symbol has a plurality of black and white vertical stripes each having a predetermined width stipulated by the standard as is well known. They are called black bars and spaces. Light with different reflectance is reflected depending on a lateral width of each of the black bars and the spaces.

Rays L**2** (indicated by the broken-line arrows in FIG. **5**) reflected from the bar code symbol pass through the opening **19** again and enter the vibration mirror **41** to be reflected. Their reflected lights are collected by the collector mirror **50**. At this time, since the vibration mirror **41** vibrates due to a magnetic force generated between the coil unit **45** and the movable magnet **43**, it is possible for the lights in a wide range reflected from the bar code symbol to enter and to be sent to the collector mirror **50**. Then, the lights collected by the collector mirror **50** are all received by the light-emitting element **61** of the light-receiving sensor **60**.

The light-receiving sensor **60** outputs an electrical signal according to the intensity of the light received by the light-receiving element **61** and sends the electrical signal to the circuit board **70**. In the circuit board **70**, the electrical signal is A/D converted and thereafter the digital signal is processed, whereby data read from the bar code symbol is obtained.

By assembling this module **1** for the optical information reader in a not-illustrated case together with a power supply part and so on, it is possible to easily complete a compact optical information reader such as a hand-held bar code reader.

Next, a characterizing structure in the light beam generating part of this module **1** for the optical information reader, a method of the collimation adjustment (also called focus adjustment), and a fixing method of the collimator lens unit **30** and the module casing **10** after this adjustment will be described based on FIG. **6**, FIG. **7**, FIG. **8**A, and FIG. **8**B.

FIG. **6** is an enlarged partial sectional view illustrating the light beam generating part in FIG. **5** together with the adjust pin, and FIG. **7** is a partial sectional view taken along VII-VII line in FIG. **6**. In these drawings, the light-emitting unit **20** is entirely cross-hatched in the same manner, and the collimator lens unit **30** is also entirely hatched in the same manner.

FIG. **8**A is a sectional view schematically illustrating a cross section similar to that in FIG. **7** to explain characteristics of the collimation adjustment according to the embodiment of the invention, and FIG. **8**B is a sectional view illustrating a state after the adhesive for fixing this collimator lens unit **30** to the module casing is cured. In these drawings, the hatching of the collimator lens unit **30** is omitted.

As previously described, the collimator lens unit **30** has the collimator lens **31** and the aperture limit stop formation member **32** integrally fixed in the cylindrical member **33**, and is inserted in the lens-barrel hole **13***a* of the light beam generating part housing part **13** of the module casing **10** so as to be reciprocatable in the direction along the optical axis X within the predetermined range. Thus, an outside diameter of the cylindrical member **33** is slightly smaller than an inside diameter of the lens-barrel hole **13***a* and there exists a small gap between the both.

In a peripheral sidewall of the lens-barrel hole **13***a* in the light beam generating part housing part **113** of the module casing **10**, a long hole **131**) through which the adjust pin **5** penetrates so as to be reciprocatable in the optical axis direction (C and D directions indicated by the arrows in FIG. **6**) within a predetermined range is formed. Further, in an outer periphery of the cylindrical member **33** of the collimator lens unit **30**, a fitting portion **33***a* in which a tip portion of the adjust pin **5** penetrating through the long hole **13***b* is fit is formed. The fitting portion **33***a* is a recessed portion in this embodiment, but if a recessed portion is formed in a tip surface of the adjust pin **5**, the fitting portion of the outer periphery of the cylindrical member **33** can be a projecting portion.

On an inner peripheral surface of the lens-barrel hole **13***a* of the module casing **10**, at or near a position opposed to the fitting portion **33***a*, bearing portions **13***c* in contact with the outer peripheral surface of the cylindrical member **33** are disposed at positions symmetrical with respect to this position in terms of a circumferential direction of the lens-barrel hole **13***a*.

In this embodiment, as illustrated in FIG. **7**, the pair of bearing portions **13***c* form a V-shaped slope which is thick so as to make an inside diameter of the inner peripheral surface of the lens-barrel hole **13***a* smaller than that at the other portion of the inner peripheral surface. Accordingly, when the collimator lens unit **30** is pressed in the arrow F direction in FIG. **7** by the adjust pin **5**, the bearing portions **13***c* come into point contact with the outer peripheral surface of the cylindrical member **33** at P points illustrated in FIG. **8**A in the circumferential direction and into line contact therewith in an axial direction. In this state, the optical axis X of the collimator lens and a light emission center of the light-emitting unit **20** coincide with each other, and the collimator lens is easily movable along the optical axis X as it is.

These bearing portions **13***c* are not limited to the V-shaped slope, but the bearing portion may be a slightly inwardly projecting curved surface formed at part of the inner peripheral surface of the lens-barrel hole **13***a*, or a curved-surface projection provided along the axial direction on the inner peripheral surface.

Further, in the bearing portions **13***c* or in the vicinity thereof, in this embodiment, in a middle region, of the V-shaped slope being the pair of bearing portions **13***c*, which is not in contact with the outer peripheral surface of the cylindrical member **33**, an open-hole **13***d* through which an adhesive for fixing the cylindrical member **33** is finable is formed.

The collimation adjustment (focus adjustment) in the light beam generating part of the module **1** for the optical information reader thus structured is performed as follows.

The module **1** for the optical information reader whose assembly is finished is fixed to a not-illustrated jig. Then, as illustrated in FIG. **6**, the tip portion of the adjust pin **5** disposed on the jig is inserted to the long hole **13***b* formed in the light beam generating part housing part **13** of the module casing **10**, and further is fit in the fitting portion **33***a* formed in the outer periphery of the cylindrical member **33** of the collimator lens unit **30**. By the adjust pin **5** being pressed in the arrow F direction illustrated in FIG. **7**, the cylindrical member **33** of the collimator lens unit **30** is pressed in the same direction, and its outer peripheral surface is brought into point contact with the pair of bearing portions **13***c* formed on the inner peripheral surface of the lens-barrel hole **13***a,* at the P points illustrated in FIG. **8**A.

When the adjust pin **5** is moved in this state in the arrow C direction or D direction illustrated M FIG. **6** by a linear feeding mechanism of the jig, the collimator lens unit **30** moves in accordance therewith along the optical axis X of the collimator lens **31**, so that its distance from the light-emitting unit **20** fixed in the lens-barrel hole **13***a* of the module casing **10** changes.

Consequently, the laser light emitted from the laser diode **21** being the light source of the light-emitting unit **20** is turned into an accurate parallel luminous flux by the collimator lens **31** of the collimator lens unit **30**, which makes it possible to perform the collimation adjustment or the focus adjustment so that the light exits as a prescribed laser beam through the aperture **32***a*.

This adjustment can be performed by moving the collimator lens unit **30** in both a direction in which it separates from the light-emitting unit **20** and a direction in which it approaches the light-emitting unit **20**, and therefore in a case where the adjustment is made excessively in one of the directions, it is possible to return it for re-adjustment, so that a defective product due to the poor collimation adjustment scarcely occurs. The adjust pin **5** can be moved by a linear motor mechanism, a fine-pitch ball screw mechanism, or the like, and delicate adjustment can be easily made.

After the collimation adjustment is thus finished, as illustrated in FIG. **8**A, while the collimator lens unit **30** is pressed in the arrow F direction by the adjust pin **5** to be pressed against the pair of bearing portions **13***c*, the adhesive **7** is filled in the open-hole **13***d* formed in the middle portion of the pair of bearing portions **13***c* in the module casing **10** and is cured.

If, for example, an ultraviolet curing adhesive is used as this adhesive **7**, it can be cured in a short time by being irradiated with ultraviolet light after being filled.

Owing to the curing of the adhesive **7**, the collimator lens unit **30** is bonded and fixed to the module casing **10** while being kept at such a predetermined position that part of its outer peripheral surface abuts on the pair of bearing portions **13***c,* and even if the pressing of the collimator lens unit **30** is released as illustrated in FIG. **8**B by pulling out the adjust pin **5**, the optical axis of the collimator lens **31** does not deviate or tilt.

Thereafter, when the adhesive is injected also from the long hole **13***b* for adjust pin insertion and is cured, it is possible to more surely fix the collimator lens unit **30** to the module casing **10**.

On the other hand, in a reference example, as illustrated in FIG. **11**A, it is assumed that an inner peripheral surface of a lens-barrel hole **10***a* of a module easing **10'** is formed as a round cylindrical surface without having bearing portions, and the adhesive **7** is filled and cured in a gap (clearance) between the inner peripheral surface and the outer peripheral surface of the collimator lens unit **30**.

In this case, as illustrated in FIG. **11**B, the collimator lens unit **30** is likely to be bonded and fixed to the lens-barrel hole **10***a* of the module casing **10'** in a state where the axis of the collimator lens unit **30**, that is, the optical axis of the built-in collimator lens is deviated from or tilted relatively to a central axis of the lens-barrel hole **10***a*.

This is because, due to the adhesive **7** filled in the clearance between the outer peripheral surface of the collimator lens unit **30** and the inner peripheral surface of the lens-barrel hole **10***a,* the collimator lens unit **30** is in a floating state in the lens-barrel hole **10***a,* and when the adhesive **7** is cured, contraction stresses are generated as illustrated by many arrows in FIG. **11**A, and due to unevenness or the like of an application amount of the adhesive, its strength differs depending on each circumferential-direction position.

Incidentally, in this embodiment, the collimator lens **31** and the aperture limit stop formation member **32** are integrally fixed to the cylindrical member **33** to form the collimator lens unit **30**, but instead, an aperture limit stop formation part and a cylindrical part may be integrally provided on the collimator lens itself to form the collimator lens unit. Further, the collimator lens and the cylindrical part may be integrally formed of the same material or different kinds of materials, and the aperture limit stop formation part may be integrally fixed to the resultant to form the collimator lens unit.

Incidentally, in the module **1** for the optical information reader of this embodiment, since the module casing **10** is formed of resin, the support shaft **44** of the vibration mirror **41** is liable to lack support strength if being supported in a cantilever manner. Here, a structure for enhancing the support strength will be described based on FIG. **3** and FIG. **9**. FIG. **9** is a sectional view taken along IX-IX line in FIG. **3**, and the vibration mirror driver **40** is entirely hatched in the same manner.

As illustrated in FIG. **9**, on the bottom surface portion **11** of the module casing **10** (including the vibration mirror driver attachment part **16**), the boss **11***a* is formed and a lower end portion of the support shaft **44** of the vibration mirror **41** is fit therein to be supported. An upper end portion of this support shaft **44** loosely penetrates through a through hole **70***a* formed in the circuit board **70** to protrude upward, and a holder disk **48** having a center hole is fit therearound as illustrated in FIG. **3** and FIG. **9** and this holder disk **48** is bonded or soldered to the upper surface of the circuit board **70** to be fixed.

With this structure, the support shaft **44** of the vibration mirror **41** is supported at two points by the bottom surface portion **11** of the module casing **10** and the circuit board **70**, which eliminates a risk of its tilting. Further, even when the support shaft **44** receives an external force such as a drop impact, a load for the bottom surface portion **11** of the module casing **10** to support the support shaft **44** is reduced.

Instead of the holder disk **48** having the center hole, a holder member in a hat shape having a recessed portion where to fit the upper end portion of the support shaft **44** and a flange portion may be used.

Next, FIG. **10** is a perspective view illustrating an embodiment in which a metallic foil is affixed on an outer wall surface of the module casing **10** to enhance a shielding effect, with the circuit board **70** removed.

In this embodiment using the photodiode (PD) as the light-receiving sensor **60**, in order to more ensure a noise

countermeasure, a metallic foil **9** is affixed on the outer wall surface, of the above-mentioned resin module casing **10**, at least near a portion housing the light-receiving sensor **60** having the built-in photodiode as illustrated in FIG. **10**, to thereby enhance the shielding effect.

Optical information read by the optical information reader including the module for the optical information reader according to the invention is not limited to bar codes but may be various kinds of two-dimensional codes such as PDF417, a QR code, and Aztec Code.

Hitherto, the embodiments of the invention have been described, but the invention is not limited to these, and it goes without saying that, in carrying out the invention, addition and changes can be appropriately made to their structures, part of the structures may be omitted, or shapes and materials may be changed.

The structures of the above-described embodiments and modification examples can of course be carried out by being arbitrarily combined as long as they are not mutually inconsistent.

INDUSTRIAL APPLICABILITY

The module for the optical information reader according to the invention is applicable to various kinds of optical information readers such as a bar code reader.

What is claimed is:

1. A module for an optical information reader in which a light-emitting unit having a light source, a collimator lens, a vibration mirror for scanning, a collector mirror or a condenser lens, and a light-receiving sensor are disposed in a module casing to be modularized,

wherein a collimator lens unit, in which an aperture limit stop formation member and the collimator lens are integrally disposed in a cylindrical member, is inserted in a lens-barrel hole of the module casing so as to be reciprocatable in an optical axis direction within a predetermined range, and the light-emitting unit is fixed to the module casing in the lens-barrel hole, with an optical axis of the light source aligned with an optical axis of the collimator lens, and wherein the aperture limit stop formation member radiates an output laser beam,

wherein a long hole through which an adjust pin is penetrated so as to be reciprocatable in the optical axis direction within a predetermined range is formed in a peripheral sidewall of the lens-barrel hole of the module casing, and a fitting portion in which a tip portion of the adjust pin penetrating through the long hole is fit is formed in an outer peripheral surface of the cylindrical member,

wherein, on an inner peripheral surface of the lens-barrel hole of the module casing, at a position diametrically opposite from the long hole and the fitting portion, a pair of bearing portions which, in a circumferential direction, are in point contact with the outer peripheral surface of the cylindrical member, and in an axial direction, are in line contact with the outer peripheral surface are formed at positions symmetrical with respect to the position in terms of an inner circumferential direction of the lens-barrel hole,

wherein an open-hole through which an adhesive for fixing the cylindrical member is fillable is formed in a middle region of the pair of bearing portions, and

wherein the bearing portions form a V-shaped slope by two flat surfaces which, in a circumferential direction, are in point contact with the outer peripheral surface of the cylindrical member, and in an axial direction, are in line contact with the outer peripheral surface.

2. The module for the optical information reader according to claim **1**, wherein an open-hole through which an adhesive for fixing the cylindrical member is fillable is formed in a middle region, of the V-shaped slope, which is not in contact with the outer peripheral surface of the cylindrical member.

3. The module for the optical information reader according to claim **1**, wherein the collimator lens unit is structured such that the collimator lens and the aperture limit stop formation member are fixed to the cylindrical member.

4. The module for the optical information reader according to claim **1**, wherein the collimator lens unit is structured such that the aperture limit stop formation member and the cylindrical member are integrally disposed on the collimator lens itself.

5. The module for the optical information reader according to claim **1**, wherein the collimator lens unit is structured such that the collimator lens and the cylindrical member are integrally formed of the same material or different kinds of materials, and to the resultant formed body, the aperture limit stop formation member is fixed.

6. The module for the optical information reader according to claim **1**, wherein the module casing is formed of resin.

7. The module for the optical information reader according to claim **6**, wherein the resin is reinforced resin in which carbon is dispersed.

8. The module for the optical information reader according to claim **6**, wherein a metallic foil is affixed on an outer wall surface of the module casing made of the resin, at least near a portion where the light-receiving sensor is housed.

* * * * *

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION

HONEYWELL INTERNATIONAL INC., HAND HELD PRODUCTS, INC., and METROLOGIC INSTRUMENTS, INC.,	
Plaintiffs,	Case No. 3:21-cv-00506
v.	JURY TRIAL DEMANDED
OPTO ELECTRONICS CO., LTD.,	
Defendant.	

DEFENDANT'S REPLY IN SUPPORT OF
MOTION FOR SUMMARY JUDGMENT

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TABLE OF AUTHORITIES

I. INTRODUCTION

The Court can resolve OPTO's Motion for Summary Judgment (Dkt. 133) by construing the definition of "2D Barcode Products" based on the plain language set forth in the parties' Settlement and License Agreement ("the Agreement") and the documents expressly incorporated by reference therein. That intrinsic record makes clear that the Agreement defines 2D Barcode Products with reference to the readily ascertainable product operations and structures expressly set forth in Section 1.4 of the Agreement. As guided by controlling Delaware contract law, reading the entire three-sentence definition of 2D Barcode Products in Section 1.4 as a whole produces only one unambiguous definition that encompasses only OPTO's 2D imaging products—not its laser-scanning products.

Despite acknowledging that Delaware courts assess contractual intent objectively, Honeywell invites the Court to rewrite Section 1.4's commercially practical definition of 2D Barcode Products into a recipe for endless litigation that no sensible businessperson would have accepted as a condition of a contract. Honeywell wrongly insists that the definition of 2D Barcode Products turns on fluid and mutable definitions of "two-dimensional barcode symbologies," which are found not in the Agreement, and on ***any and all*** third-party writings that purport to define a barcode symbol as "two dimensional." Honeywell's interpretation therefore "produces an absurd result . . . that no reasonable person would have accepted when entering the contract." *Osborn v. Kemp*, 991 A.2d 1153, 1160 (Del. 2010).

The Court should accordingly reject Honeywell's asserted contract interpretation and dismiss Honeywell's Complaint because there is no genuine dispute of material fact as to whether OPTO has fully paid all royalties due and owing under the Agreement. OPTO paid in full.

II. ARGUMENT

In *Osborn*, the Delaware Supreme Court cited with approval authority from other jurisdictions directing courts to reject contract interpretations that lead to absurd results in favor of a construction that "'would accord with reason and probability.'" *Osborn*, 991 A.2d at 1160 n.21 (quoting *Huntingdon on the Green Condo. v. Lemon Tree I-Condo*, 874 So.2d 1, 5 (Fla. Dist. Ct. App. 2004)); *see also Born v. Hammond*, 146 A.2d 44, 47 (Md. 1958); *Gore v. Beren*, 867 P.2d 330, 337 (Kan. 1994). Honeywell's asserted interpretation in this case should be rejected because it produces just such an absurd result by subjugating the meaning of 2D Barcode Products to the influence of unspecified extrinsic definitions of "two-dimensional barcode symbologies," which can change at any time by the stroke of a third-party's pen.

A. Honeywell's Interpretation Produces an Absurd Result

According to Honeywell, the first sentence of Section 1.4 defines "2D Barcode Products" as "any device that is operable to decode a ***two-dimensional barcode symbology***." Dkt. 157 at 8 (emphasis added). The fundamental flaw in Honeywell's asserted interpretation is that the emphasized term, "two-dimensional barcode symbology," is defined nowhere in the Agreement, which Honeywell does not dispute. Nor does Honeywell dispute that the Agreement incorporates no extrinsic definition of that term by reference. *See id.* at 10. Absent a definition of "two-dimensional barcode symbology," Honeywell's asserted interpretation is ambiguous because, at best, it is susceptible to more than one reasonable interpretation. *See* Dkt. 135 at 4-10.

Honeywell purports to cure this ambiguity by pointing to the second sentence of Section 1.4, which merely states that "[t]wo-dimensional barcode symbologies include, but are not limited to," 2D symbols defined by standards setting organizations. Dkt. 157 at 10. As Honeywell stresses, the "include, but are not limited to" language means that "in addition to industry standards, the Agreement allows for a party to look to ***other sources such as***: (1) past marketing materials, (2)

current marketing materials, (3) the understanding of its employees, or (4) patents to understand what is commonly understood as a 'two-dimensional barcode symbology.'" *Id*. (citations omitted) (emphasis added).

Although Honeywell's list refers to OPTO documents, the emphasized "other sources such as" language makes clear that Honeywell's alleged "sources" of 2D barcode definitions are not limited to the parties' own materials—the list extends to ***any and all*** third-party definitions. In other words, according to Honeywell, the term "two-dimensional barcode symbologies" ***can mean anything anyone says it means***. Therein lies the fundamental absurdity of Honeywell's position—if one "source" defines a particular symbol as "two-dimensional," then it is a 2D symbol regardless of contrary or conflicting definitions or evidence.

Moreover, the emphasized "***current*** marketing materials" language demonstrates Honeywell's concession that its definition of 2D Barcode Products is fluid and subject to change based on 2D barcode definitions arising even ***after*** the Effective Date of the Agreement. By the stroke of a third-party's pen, therefore, a 2D Barcode Product today might not be a 2D Barcode Product tomorrow, or *vice versa*. Under the objective lens of Delaware contract law, Honeywell's interpretation results in a contract term "that no reasonable person would have accepted when entering the contract"—let alone these sophisticated parties and their counsel. *Osborn*, 991 A.2d at 1160. In reality, the parties did not delegate the scope and meaning of their duties under the Agreement to third parties. They expressly agreed that the Agreement is an integrated contract, and its terms can be modified "only by a written instrument signed by the Parties." Agreement at § 9.2. Thus, Honeywell's position results in an interpretation that is not only absurd but also contrary to the plain language in the Agreement.

B. Extrinsic Definitions Are Excluded from the Integrated Agreement

According to Honeywell's asserted definition of 2D Barcode Products, the term "two-dimensional barcode symbologies" is a material term. Yet without defining the term for any given barcode symbol, one cannot know whether a device that decodes the symbol is a 2D Barcode Product. Incredibly, in its own motion for summary judgment, Honeywell says that it "is not asking the Court to determine what is and what is not a two-dimensional barcode symbology," even though its professed definition of 2D Barcode Products is meaningless without defining that term. Dkt. 144 at 1, n.1. Apparently, the Court need not concern itself with defining the term, because the second sentence allegedly authorizes Honeywell to cherry pick extrinsic definitions of 2D barcode symbologies from a mutable and innumerable set of unspecified third-party writings.

Delaware law, however, precludes Honeywell's purported reliance on extrinsic definitions of 2D barcode symbologies, and Honeywell's asserted definition of 2D Barcode Products is therefore legally inoperative. Honeywell concedes that the Agreement (1) is unambiguous, (2) does not incorporate definitions of 2D barcode symbologies by reference, and (3) includes an integration clause expressing the parties' assent that the Agreement and its four exhibits "constitute and contain the entire agreement." Dkt. 157 at 11; Agreement at § 9.2.

Delaware law prohibits the use of extrinsic evidence in interpreting an unambiguous integrated contract:

> The general rule of contract interpretation for integrated agreements implicates the parol evidence rule. "The parol evidence rule excludes evidence of additional terms to a written contract, when that contract is a complete integration of the agreement of the parties." "If a contract is unambiguous, extrinsic evidence may not be used to interpret the intent of the parties, to vary the terms of the contract or to create an ambiguity."

I.U. N. Am., Inc. v. A.I.U. Ins. Co., 896 A.2d 880, 885 (Del. Super. Ct. 2006) (quoting *Husband (P.J.O.) v. Wife (L.O.)*, 418 A.2d 994, 996 (Del. 1980); *Eagle Indus., Inc. v. DeVilbiss Health Care, Inc.*, 702 A.2d 1228, 1232 (Del. 1997)).

Delaware law thus precludes the use of non-incorporated extrinsic evidence to supply the definition of the term "two-dimensional barcode symbology" for any given barcode symbol within the context of Honeywell's purported interpretation. For example, in *I.U. North America*, the court interpreted the term "Asbestos-Related Bodily Injury Claims" in a settlement agreement between CGU Insurance and its customers, Pfizer and Quigley Company. *See* 896 A.2d at 884. Just as the Court here is called upon to construe the definition of "2D Barcode Products," the court in that case interpreted the claims definition in the settlement agreement to determine the extent to which CGU was obligated to insure Pfizer/Quigley against claims arising from asbestos related injuries. *Id*. CGU contended that it was obligated to insure against asbestos-related injuries caused only by Pfizer/Quigley, who in turn asserted that CGU was further required to reimburse them for additional payments they made in connection with asbestos-related injuries caused by other defunct producers due to joint and several liability. *Id*.

Prior to their settlement agreement with CGU, Pfizer/Quigley entered into two agreements with other asbestos producers to coordinate payments to individual claimants. *Id*. at 882-85. The first agreement, the "Wellington Agreement," limited each producer's payment obligations to only those injuries caused by the producer's own products. *Id*. The second agreement, the "Producer Agreement," expressly superseded the Wellington Agreement and extended each producer's obligation to payments owed by other defaulting producers—obligations that the remaining solvent producers bore due to joint and several liability. *Id*.

CGU was a party to neither agreement. *Id*. at 883, 888. However, the Pfizer/Quigley/CGU settlement agreement, which concluded the insurance coverage litigation between CGU and Pfizer/Quigley, expressly incorporated the Wellington Agreement by reference, and CGU argued that it was only required to insure Pfizer/Quigley to the extent of their obligations under the Wellington Agreement. *Id*. at 887-89. The court agreed with CGU. *Id*. Even though the Producer Agreement had superseded the Wellington Agreement before CGU settled with Pfizer/Quigley, the settlement agreement did not incorporate the Producer Agreement by reference, and so the Producer Agreement played no role in defining CGU's obligations under the parties' settlement agreement. *Id*. at 888.

In the same way, extrinsic third-party definitions play no role in defining the term "two-dimensional barcode symbologies" here—under Honeywell's asserted definition of 2D Barcode Products or otherwise. Thus, the first two sentences of Section 1.4 do not, by themselves, define the term 2D Barcode Products.

C. Delaware Law Guides the Correct Interpretation of 2D Barcode Products

While confirming that Honeywell's proposed interpretation of "2D Barcode Products" is legally inoperative, Delaware law guides the correct construction of that term. When construing a contract provision such as Section 1.4 that begins with broad general language followed by specific language, Delaware law directs that "[s]pecific language in a contract controls over general language." *DCV Holdings, Inc. v. ConaAgra, Inc., et al.*, 889 A.2d 954, 961 (Del. 2005). And "courts construing contracts must give specific terms and exact terms . . . greater weight than general language." *Cnty. of Suffolk v. Alcorn*, 266 F.3d 131, 139 (2d Cir. 2001) (internal citations omitted).

Moreover, under Delaware law, a court must "rely on a reading of all of the pertinent provisions of the [contract] as a whole, and not on any single passage in isolation," as Honeywell

wrongly urges with respect to the first sentence of Section 1.4. *O'Brien v. Progressive N. Ins. Co.*, 785 A.2d 281, 287 (Del. 2001); *see also TQ Delta, LLC v. Adtran, Inc.*, No. 1:14-CV- 00954, 2018 WL 2298342, at *5 (D. Del. May 18, 2018) (reading patent "carve out" sentence together with the next sentence beginning with the words "For clarity" as a whole resulted in one unambiguous definition).

1. The first sentence of Section 1.4

Section 1.4 begins with the words, "The term '2D Barcode Products' ***shall mean***. . . ." As discussed, Delaware law makes clear that the first sentence (even combined with the second sentence) is legally inoperative as a definition of 2D Barcode Products. The "shall mean" signal in the first sentence therefore denotes not the first sentence but instead the entirety of Section 1.4 as defining 2D Barcode Products—all three sentences, ensuring that they are construed consistent with Delaware law as a whole. *See O'Brien*, 785 A.2d at 287.

The first sentence's "operable to decode" language therefore sits within the context of those three sentences and must not be construed in isolation. Although Delaware courts may consider dictionary definitions of undefined terms, they recognize that "the words they contain do not appear in their natural habitat." *In re P3 Health Grp. Holdings, LLC*, 282 A.3d 1054, 1066 (Del. Ch. 2022). Therefore, "[i]n addition to relying on dictionary definitions, a court may look to how a term or phrase is used in a particular legal context." *Id.* at 1067. Consequently, Delaware courts consider dictionary definitions only when "a term's definition is not altered or has no 'gloss' in the [relevant] industry." *Lorillard Tobacco Co. v. Am. Legacy Found.*, 903 A.2d 728, 740 (Del. 2006) (internal quotations omitted) (emphasis and brackets in original). For that reason, Honeywell's reliance on dictionary definitions is misplaced.

Recognizing that the first sentence in isolation is legally inoperative as a definition of 2D Barcode Products and reading Section 1.4 as a whole, it becomes clear that the phrase "operable

to decode" is not limited to its dictionary meaning. The third sentence clarifies that the term "operable to decode … two-dimensional barcode symbologies" is satisfied when a device is merely "capable of outputting a 2D image that may be used to decode a 2D barcode symbology."

The term "operable to decode" also has an associated minimum product structure—a 2D image sensor—that adds further specificity and clarity to the definition of 2D Barcode Products. A businessperson can readily and unambiguously identify a 2D Barcode Product with reference to these minimum product operations and structures that satisfy the terms "operable to decode … two-dimensional barcode symbologies" as that term is used within Section 1.4. If the parties had intended to include laser scanners in this definition, the minimum product operations and structures of laser scanners needed to satisfy the "operable to decode" limitation would have and could have been included—but they were not, providing intrinsic evidence of the parties' intention to exclude them from the definition. *See MBIA Ins. Corp. v. Royal Indem. Co.*, 519 F. Supp. 2d 455, 462 (D. Del. 2007) ("The words of a contract are considered the best indicia of the parties' intent.").

2. The second sentence of Section 1.4

Because the parties defined 2D Barcode Products by their minimum operations and structures, it was not necessary to define the term "two-dimensional barcode symbologies," as it is axiomatic that a 2D image of sufficient quality "may be used to decode" 2D symbologies. The critical contribution of the second sentence was to prevent disputes about which 2D symbologies apply to the definition by confirming that all possible 2D barcode symbols are contemplated within the scope of Section 1.4. The second sentence is therefore a "without limitation" provision intended to prevent the type of dispute that is central to this case. Nothing more was either intended or accomplished by the second sentence.

3. The third sentence of Section 1.4

The third sentence of Section 1.4 is not directed solely to "niche" undecoded engines as Honeywell insists. The third sentence expressly applies to "Engines ***and other products*** that include a 2D image sensor . . . capable of outputting a 2D image." The minimum product operations and structures defined by the third sentence apply equally to both undecoded and decoded barcode scanning products. In the same way that the second sentence prevents disputes about the scope of 2D barcode symbologies applicable to 2D Barcode Products, the third sentence prevents disputes about the scope of product features relevant to defining 2D Barcode Products. Without the third sentence, even decoded engines would arguably not be "operable to decode … two-dimensional barcode symbols" until they are included in a final assembly with a power source and other control means. The third sentence therefore gives effect to a broad definition of 2D Barcode Products by precisely specifying the minimum defining characteristics of 2D Barcode Products in a way that an ordinary businessperson can understand and apply.

The third sentence's use of "shall include" underscores Section 1.4's use of the minimum product operations and functions specified to define 2D Barcode Products with clarity and precision. Honeywell wrongly argues that the Agreement's definition of the term "including" as "including without limitation" is relevant to the construction of Section 1.4. It is not. The term "including" may be a defined term, but the term "shall include" is not defined. Similarly, in other parts of the Agreement, where the word "include" appears, it is followed by "but are not limited to"—specifying an intended enlargement that is not present in the third sentence. The second sentence of Section 1.4 is one such example.

The absence of the phrase "but are not limited to" or other similar words used in conjunction with "shall include" is conspicuous and compels that the phrase "shall include" be given its imperative and exhaustive meaning. *See Babcock v. City of Newton*, 977 N.E.2d 105

(Table) (Mass. App. Ct. 2012) ("It is undisputed that lawyers for both sides negotiated and then cosigned the agreement. The omission of the phrase 'not limited to,' or similar language, is meaningful."); *see also Jones v. Schneiderman*, 974 F. Supp. 2d 322, 346-47 (S.D.N.Y. 2013) (interpretation of "shall include" as exhaustive "is bolstered by the . . . later use of the phrase 'shall include but are not limited to'").

These courts' reliance on context and usage in construing "shall include" as a term of limitation is fully consistent with Delaware law and practice. *See, e.g., Bailey v. Tektronix, Inc.*, Civ. No. 21-1268, 2022 WL 4132881, at *5 (D. Del. Sep. 12, 2022) ("The combination of 'with respect to' and 'any' in the third example, but not in the first two, suggests that the parties intended to give 'with respect to' a broader scope when they add 'any'"). Indeed, "proper interpretation of a contract generally assumes consistent usage of terms throughout the Agreement." *Imation Corp. v. Koninklijke Philips Elec. N.V.*, 586 F.3d 980, 990 (Fed. Cir. 2009).

In addition to usage and context, the fact that the first sentence (even combined with second sentence) is legally inoperative as a definition of 2D Barcode Products under Delaware law further compels that the phrase "shall include" in the third sentence be given its imperative and exhaustive meaning. Interpreting "shall include" as "may include" would decouple the third sentence from the first two, resulting in an inoperative and ambiguous definition of 2D Barcode Products for the reasons discussed above and in OPTO's opening brief.

D. OPTO Applies Delaware Law to the Interpretation of the Agreement

OPTO does not, as Honeywell accuses, seek "to re-write the Agreement so that it may avoid liability for its breach." Dkt. 157 at 16. As discussed above and in its opening brief, OPTO merely shows how Honeywell's asserted interpretation of Section 1.4 is, under Delaware law and generally accepted rules of contract interpretation, legally inoperative and produces an absurd

result. For that reason, OPTO rejected Honeywell's royalty demands based on that misguided reading of the Agreement.

Contrary to Honeywell's assertion, Section 1.4's definition of royalty-bearing 2D Barcode Products is not a patchwork of independently operating definitions of 2D Barcode products. And the second sentence of Section 1.4 grants neither party license to cherry-pick extrinsic third-party definitions of "two-dimensional barcode symbologies" to change their obligations and rights under the Agreement.

Section 1.4, when properly read as a whole and consistent with Delaware law, clearly and unambiguously defines royalty-bearing 2D Barcode Products by reference to minimum product operations (capable to output a 2D image of a 2D barcode symbol) and structure (2D image sensor). Section 1.4 includes a necessary but incomplete product category definition in the first sentence to avoid an overreach of that broad definition, which might otherwise improperly encompass digital cameras and other imaging devices that bear no relationship to the licensed patents. The second sentence confirms that the definition of 2D Barcode Products is in no way limited by the type of two-dimensional barcode symbol that may be decoded by images outputted by a 2D Barcode Product.

OPTO has never disputed nor contested that plain construction of Section 1.4. OPTO has, in fact, timely and fully paid all royalties due and owing on the sales of its 2D Barcode Products, which include only OPTO's 2D imaging products. Honeywell neither disputes those payments nor complains that OPTO has failed to timely pay royalties due and owing on its 2D imaging products. There is, therefore, no genuine dispute of material fact regarding OPTO's payment of royalties due and owing on its 2D imaging products, and the Court may enter summary judgment dismissing Honeywell's Complaint and ending this unfounded and misguided litigation.

III. CONCLUSION

For the foregoing reasons, OPTO respectfully request that Court grant its motion for summary judgment and issue an order dismissing Honeywell's Complaint.

Dated: March 29, 2023

Respectfully submitted,

MCGUIREWOODS LLP

/s/ Robert A. Muckenfuss
Robert Muckenfuss, NC State Bar #28218
Zachary L. McCamey, NC State Bar #53540
Jessica O'Brien, NC State Bar #56679
MCGUIREWOODS LLP
201 N. Tryon Street, Suite 3000
Charlotte, North Carolina 28202
Telephone: 704 343 2351 Facsimile: 704 444 8869
rmuckenfuss@mcguirewoods.com
zmccamey@mcguirewoods.com
jobrien@mcguirewoods.com

Tyler T. VanHoutan
MCGUIREWOODS LLP
Texas Tower, Ste 2400
845 Texas Avenue
Houston, TX 77002
Telephone: 832-214-9911
tvanhoutan@mcguirewoods.com

Christine E. Lehman
Connor S. Houghton
REICHMAN JORGENSEN LEHMAN & FELDBERG LLP
1909 K St, NW, Suite 800
Washington, DC 20006
Telephone: 650-623-1401
clehman@reichmanjorgensen.com
choughton@reichmanjorgensen.com

York M. Faulkner
YORKMOODYFAULKNER
Tensho Bldg., 7F, Suite 711
3-17-11 Shibaura, Minato-ku
Tokyo, Japan 108-0023
Telephone: +1-202-251-0837
york.faulkner@ymf-law.com

Attorneys for Defendant Opto Electronics Co., LTD.

CERTIFICATE OF SERVICE

I hereby certify that on March 29, 2023, a copy of the foregoing was filed electronically with the Clerk of the Court for the Western District of North Carolina by using the CM/ECF system. Counsel for all parties in this case are registered CM/ECF users and will be served by the CM/ECF system.

/s/ Robert A. Muckenfuss
Robert A. Muckenfuss

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION

HONEYWELL INTERNATIONAL INC., HAND HELD PRODUCTS, INC., and METROLOGIC INSTRUMENTS, INC.,	)	
Plaintiffs,	)	Case No. 3:21-cv-00506
v.	)	JURY TRIAL DEMANDED
OPTO ELECTRONICS CO., LTD.,	)	
Defendant.	)	

DEFENDANT'S MOTION FOR SUMMARY JUDGMENT
REGARDING PLAINTIFFS' PATENT MISUSE

Defendant OPTO Electronics Co., Ltd. ("OPTO"), by and through its undersigned counsel, and pursuant to Federal Rule of Civil Procedure 56 and Local Rule 7.1, hereby respectfully moves this Court to enter summary judgment in favor of OPTO and against Plaintiffs Honeywell International Inc.; Hand Held Products, Inc.; and Metrologic Instruments, Inc. (collectively, "Honeywell") on OPTO's patent misuse counterclaim.

The grounds and authorities in support of this Motion are set forth in OPTO's Memorandum of Law in Support of its Motion for Summary Judgment Regarding Plaintiffs' Patent Misuse, and the exhibits thereto, filed contemporaneously herewith.

WHEREFORE, OPTO respectfully requests that this Court enter an order granting OPTO's Motion for Summary Judgment Regarding Plaintiffs' Patent Misuse.

Dated: March 29, 2023

Respectfully submitted,

MCGUIREWOODS LLP

/s/ Robert A. Muckenfuss
Robert Muckenfuss, NC State Bar #28218
Zachary L. McCamey, NC State Bar #53540
Jessica O'Brien, NC State Bar #56679
MCGUIREWOODS LLP
201 N. Tryon Street, Suite 3000
Charlotte, North Carolina 28202
Telephone: 704 343 2351 Facsimile: 704 444 8869
rmuckenfuss@mcguirewoods.com
zmccamey@mcguirewoods.com
jobrien@mcguirewoods.com

Tyler T. VanHoutan
MCGUIREWOODS LLP
Texas Tower, Ste 2400
845 Texas Avenue
Houston, TX 77002
Telephone: 832-214-9911
tvanhoutan@mcguirewoods.com

Christine E. Lehman
Connor S. Houghton
REICHMAN JORGENSEN LEHMAN & FELDBERG LLP
1909 K St, NW, Suite 800
Washington, DC 20006
Telephone: 650-623-1401
clehman@reichmanjorgensen.com
choughton@reichmanjorgensen.com

York M. Faulkner
YORKMOODYFAULKNER
Tensho Bldg., 7F, Suite 711
3-17-11 Shibaura, Minato-ku
Tokyo, Japan 108-0023
Telephone: +1-202-251-0837
york.faulkner@ymf-law.com

Attorneys for Defendant Opto Electronics Co., LTD.

CERTIFICATE OF SERVICE

I hereby certify that on March 29, 2023, a copy of the foregoing was filed electronically with the Clerk of the Court for the Western District of North Carolina by using the CM/ECF system. Counsel for all parties in this case are registered CM/ECF users and will be served by the CM/ECF system.

/s/ Robert A. Muckenfuss
Robert A. Muckenfuss

Exhibit 2

US007159783B2

(12) **United States Patent**
Walczyk et al.

(10) **Patent No.: US 7,159,783 B2**
(45) **Date of Patent: Jan. 9, 2007**

(54) **CUSTOMIZABLE OPTICAL READER**

(75) Inventors: **Joseph Walczyk**, Syracuse, NY (US); **Dieter Fauth**, Schorndorf (DE); **David Holzhauer**, Camillus, NY (US); **Robert M. Hussey**, Camillus, NY (US); **Barry Keys**, Batavia, NY (US); **Joseph Livingston**, Camillus, NY (US); **Michael D. Robinson**, Weedsport, NY (US)

(73) Assignee: **Hand Held Products, Inc.**, Skaneateles Falls, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/203,667**

(22) Filed: **Aug. 12, 2005**

(65) **Prior Publication Data**

US 2005/0284943 A1 Dec. 29, 2005

Related U.S. Application Data

(63) Continuation of application No. 10/402,885, filed on Mar. 28, 2003, now Pat. No. 6,959,865.

(60) Provisional application No. 60/368,375, filed on Mar. 28, 2002.

(51) **Int. Cl.**
G06K 7/10 (2006.01)

(52) **U.S. Cl.** **235/472.01**; 235/454; 235/462.15; 235/462.45; 235/472.01

(58) **Field of Classification Search** 235/472.01, 235/462.45, 462.15, 472.02
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,965,863 A *	10/1999	Parker et al.	....	235/462.25
6,899,273 B1 *	5/2005	Hussey et al.	....	235/462.48
2004/0256464 A1 *	12/2004	Longacre et al.	......	235/462.45

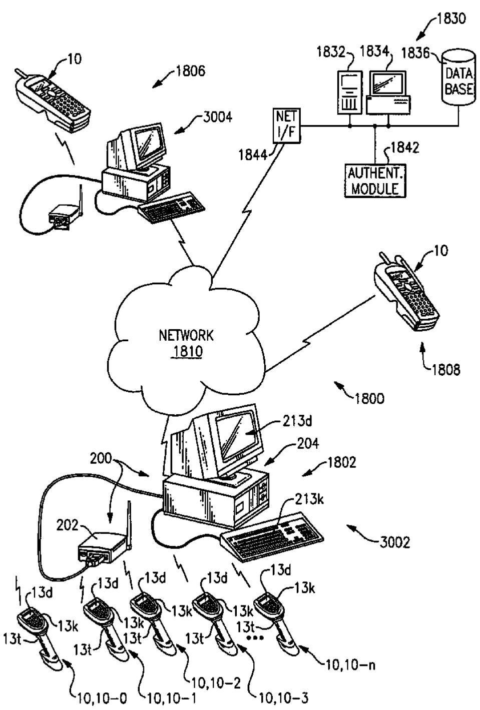
* cited by examiner

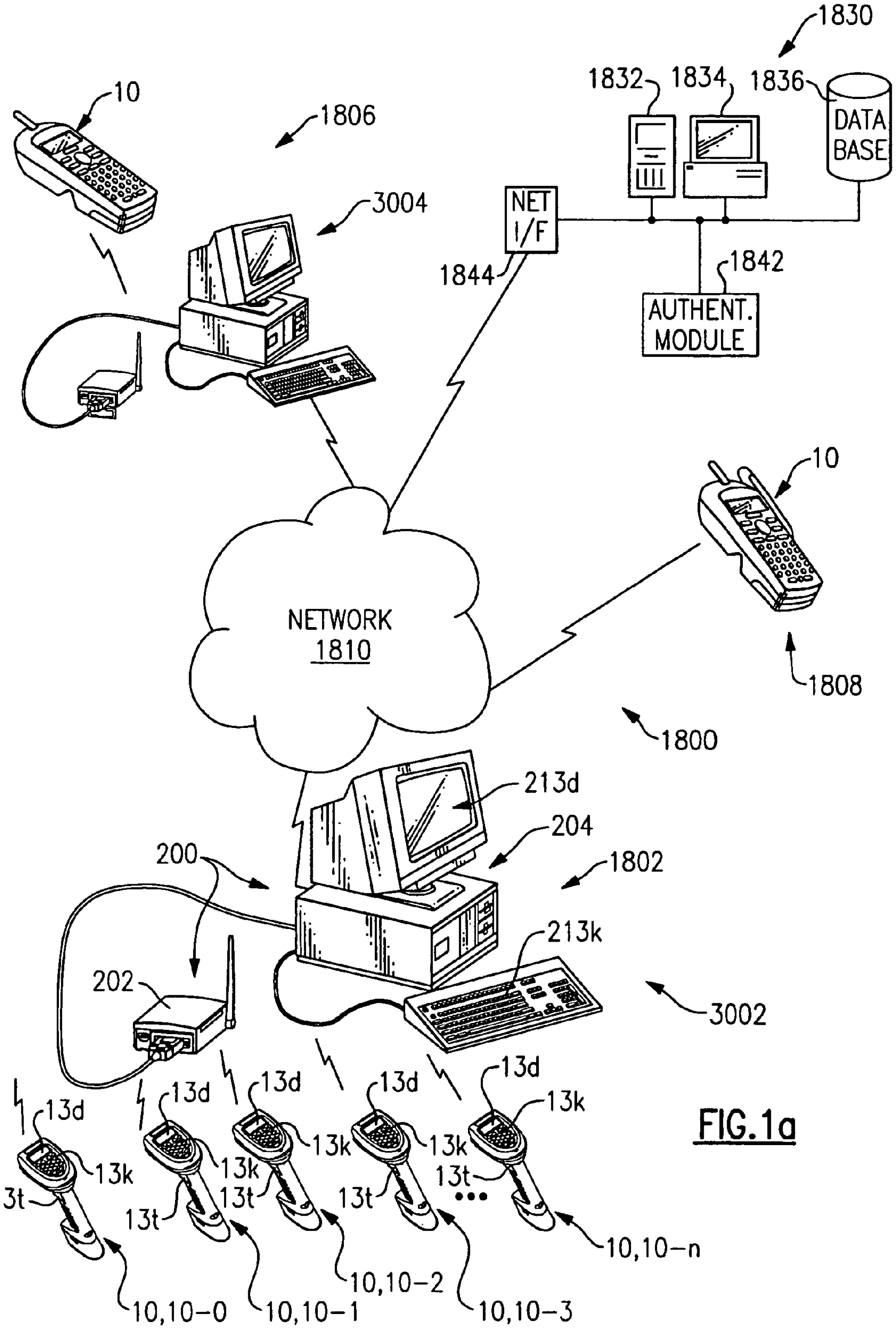
Primary Examiner—Seung Ho Lee
(74) *Attorney, Agent, or Firm*—Wall Marjama & Bilinski LLP

(57) **ABSTRACT**

An optical reader, which is operable in a "host commands" mode and a "host routines" mode. In the "host commands" mode, the reader receives and executes a script routine module from a host. In the "host routines" mode, the reader receives a script routine Module identifier from the host, and the reader, in turn, executes a selected one of a plurality of reader-stored script routine modules based on the identifier.

20 Claims, 11 Drawing Sheets




1830
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1834
1836
DATA BASE
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1806
3004
NET I/F
1844
1842
AUTHENT. MODULE
10
NETWORK 1810
1808
1800
213d
204
1802
200
213k
202
3002
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13k
13t
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10,10-n

FIG.1a

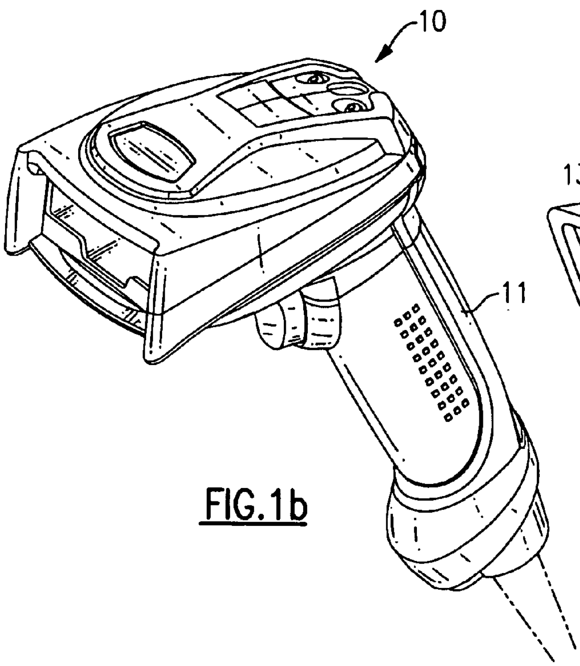


FIG. 1b

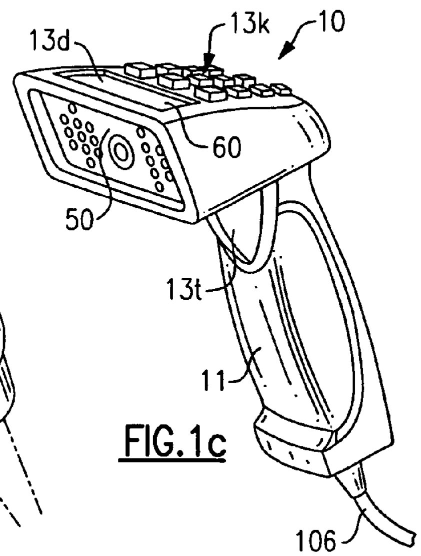


FIG. 1c

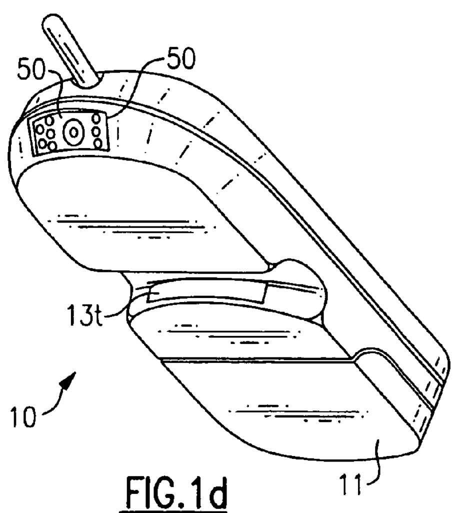


FIG. 1d

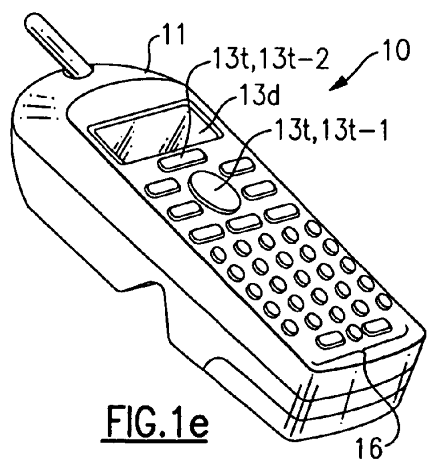


FIG. 1e

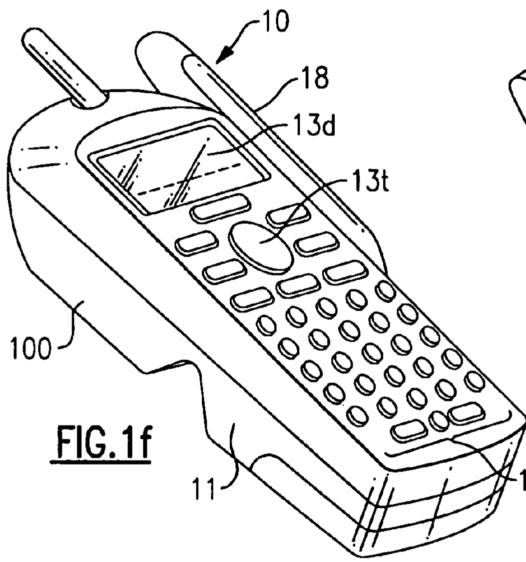


FIG.1f

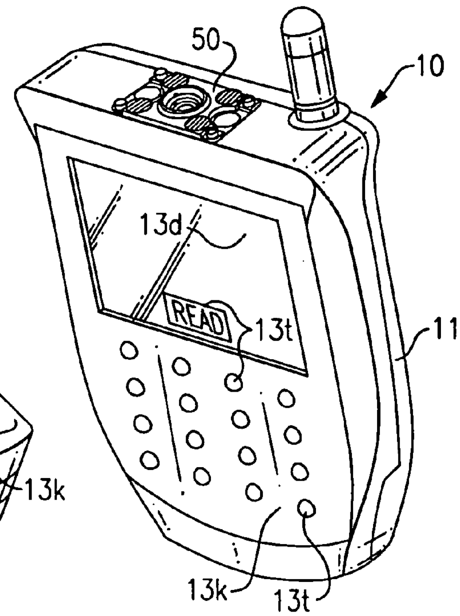


FIG.1g

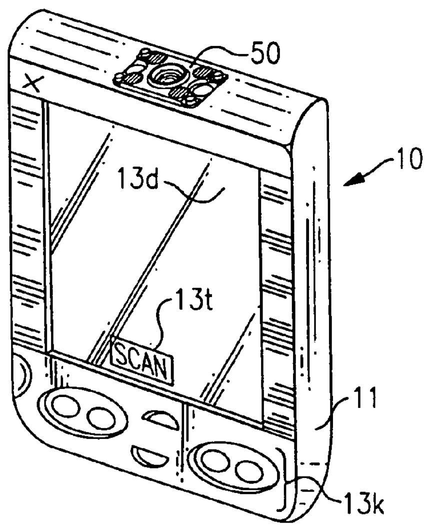


FIG.1h

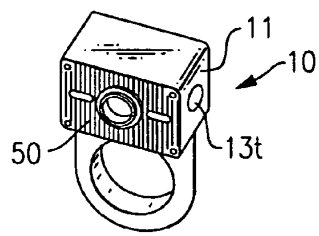


FIG.1i

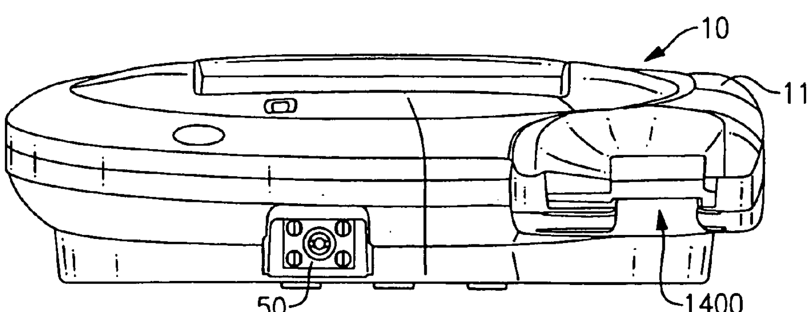


FIG.1j

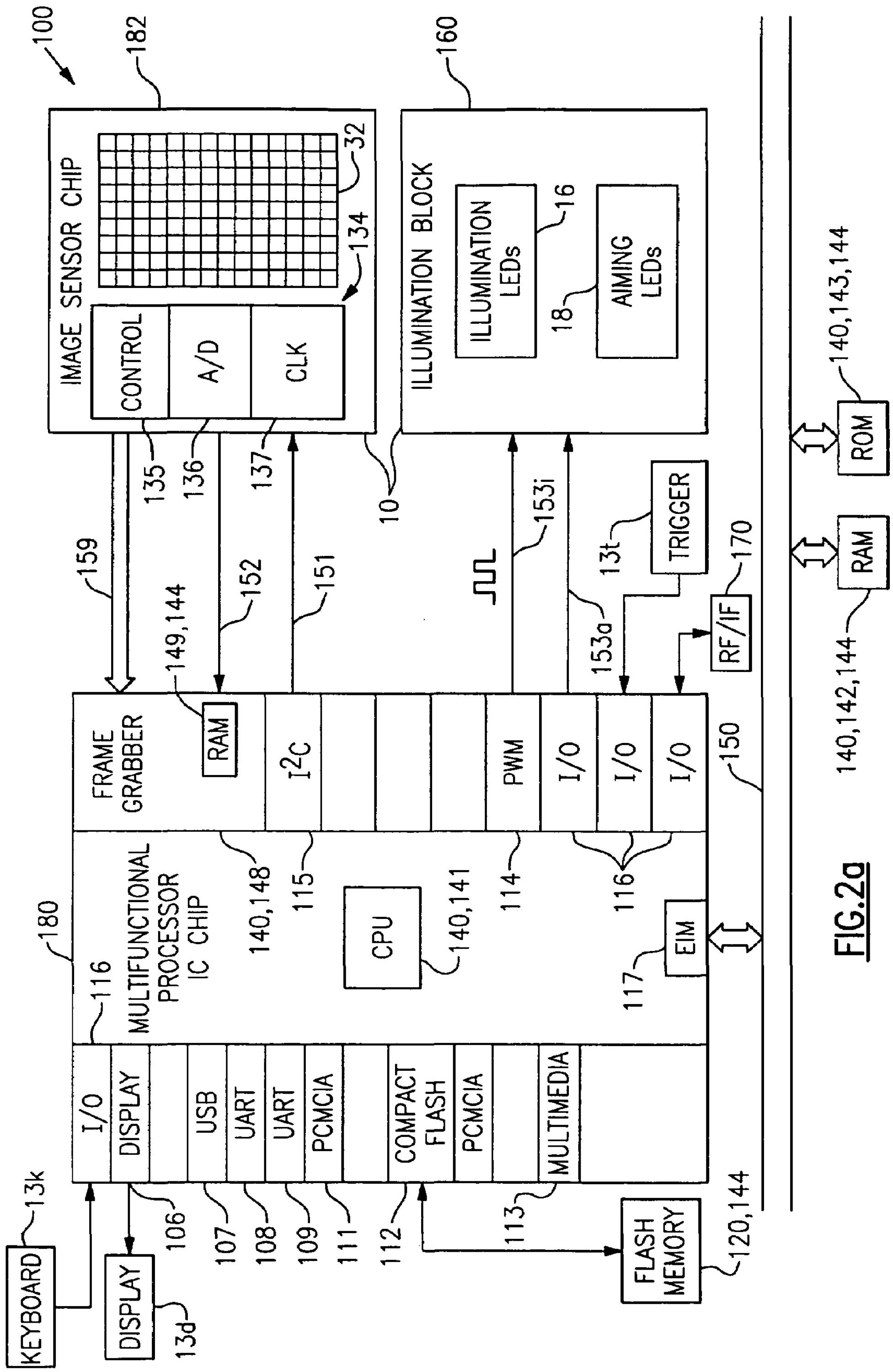

100
182
IMAGE SENSOR CHIP
32
134
CONTROL
A/D
CLK
135
136
137
160
ILLUMINATION BLOCK
ILLUMINATION LEDs
16
18
AIMING LEDs
10
159
149,144
152
151
153i
153a
13t
TRIGGER
170
RF/IF
140,143,144
ROM
RAM
140,142,144
FRAME GRABBER
RAM
I^2C
PWM
I/O
I/O
I/O
150
180
116
MULTIFUNCTIONAL PROCESSOR IC CHIP
140,148
115
CPU
140,141
114
116
117
EIM
I/O
DISPLAY
USB
UART
UART
PCMCIA
COMPACT FLASH
PCMCIA
MULTIMEDIA
13k
KEYBOARD
DISPLAY
13d
106
107
108
109
111
112
113
FLASH MEMORY
120,144

FIG.2a

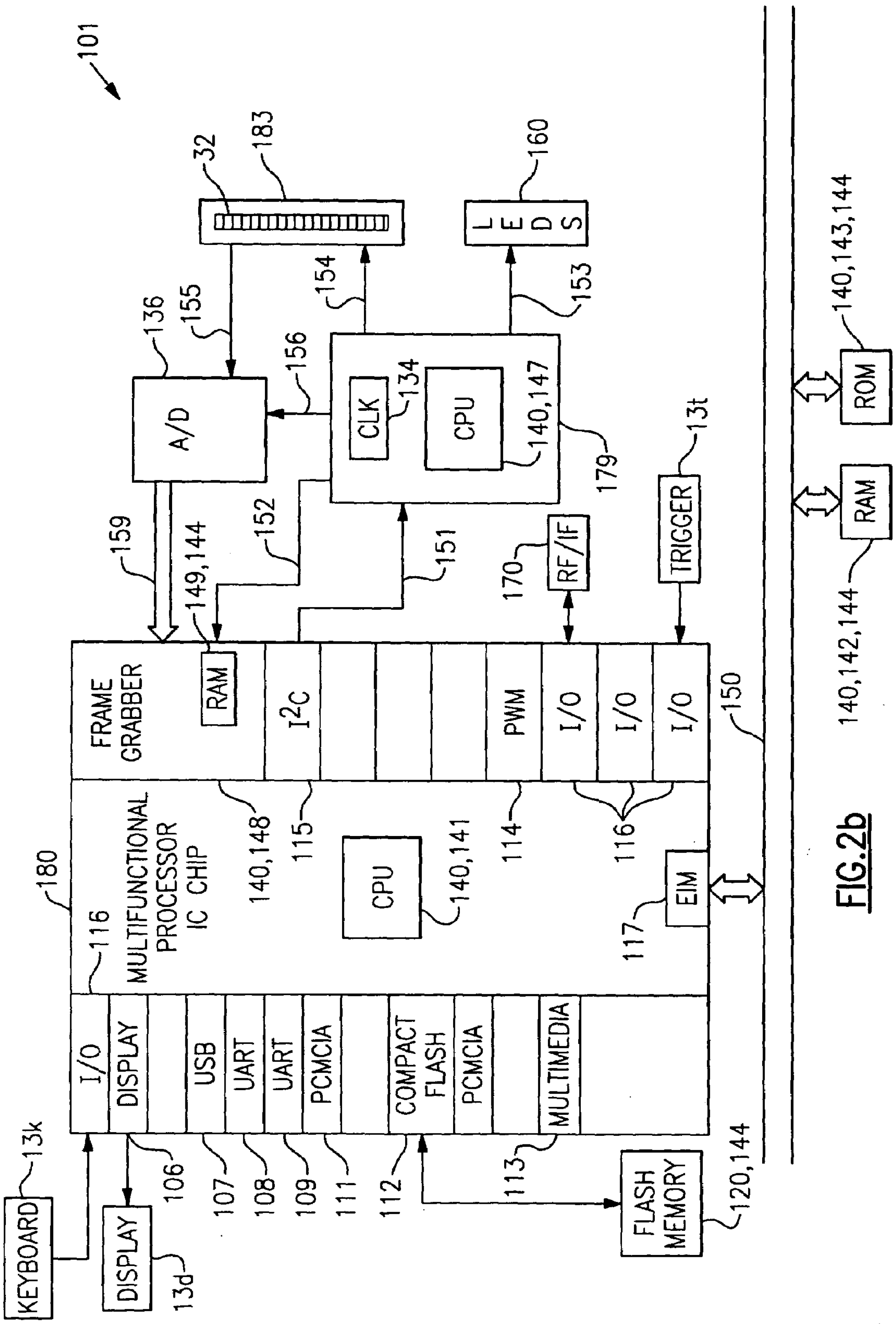

101
FRAME GRABBER
RAM
I2C
PWM
I/O
I/O
I/O
MULTIFUNCTIONAL PROCESSOR IC CHIP
CPU
EIM
I/O
DISPLAY
USB
UART
UART
PCMCIA
COMPACT FLASH
PCMCIA
MULTIMEDIA
A/D
CLK
CPU
LEDS
RF/IF
TRIGGER
RAM
ROM
KEYBOARD
DISPLAY
FLASH MEMORY
32
183
160
136
155
154
153
156
134
140,147
179
13t
159
149,144
152
151
170
150
140,143,144
140,142,144
180
116
140,148
115
140,141
114
116
117
13k
106
107
108
109
111
112
113
120,144
13d

FIG.2b

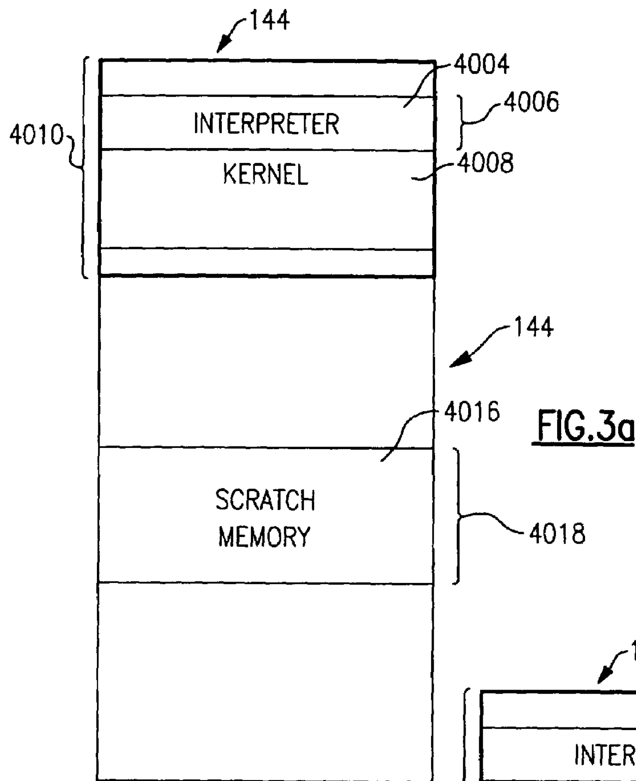

144
4004
4006
4010
INTERPRETER
KERNEL
4008
144
4016
SCRATCH
MEMORY
4018

FIG.3a

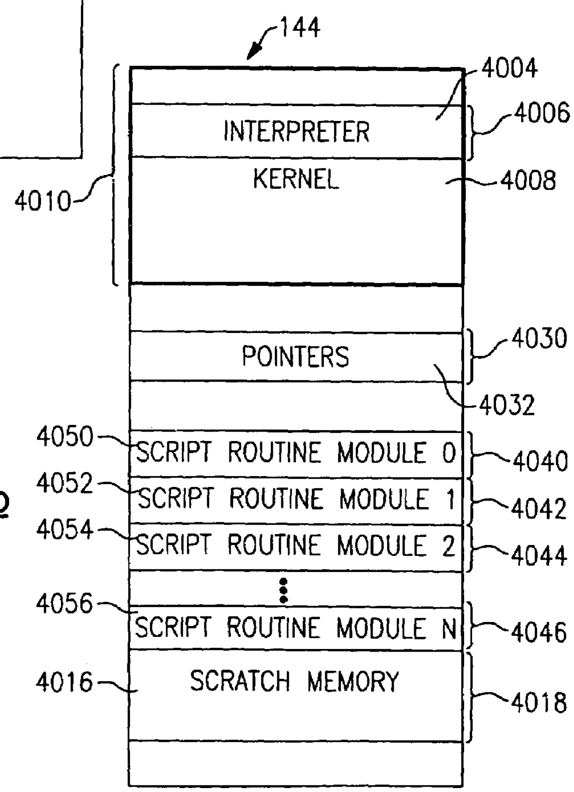

144
4004
4006
INTERPRETER
KERNEL
4008
4010
POINTERS
4030
4032
4050
SCRIPT ROUTINE MODULE 0
4040
4052
SCRIPT ROUTINE MODULE 1
4042
4054
SCRIPT ROUTINE MODULE 2
4044
4056
SCRIPT ROUTINE MODULE N
4046
4016
SCRATCH MEMORY
4018

FIG.3b

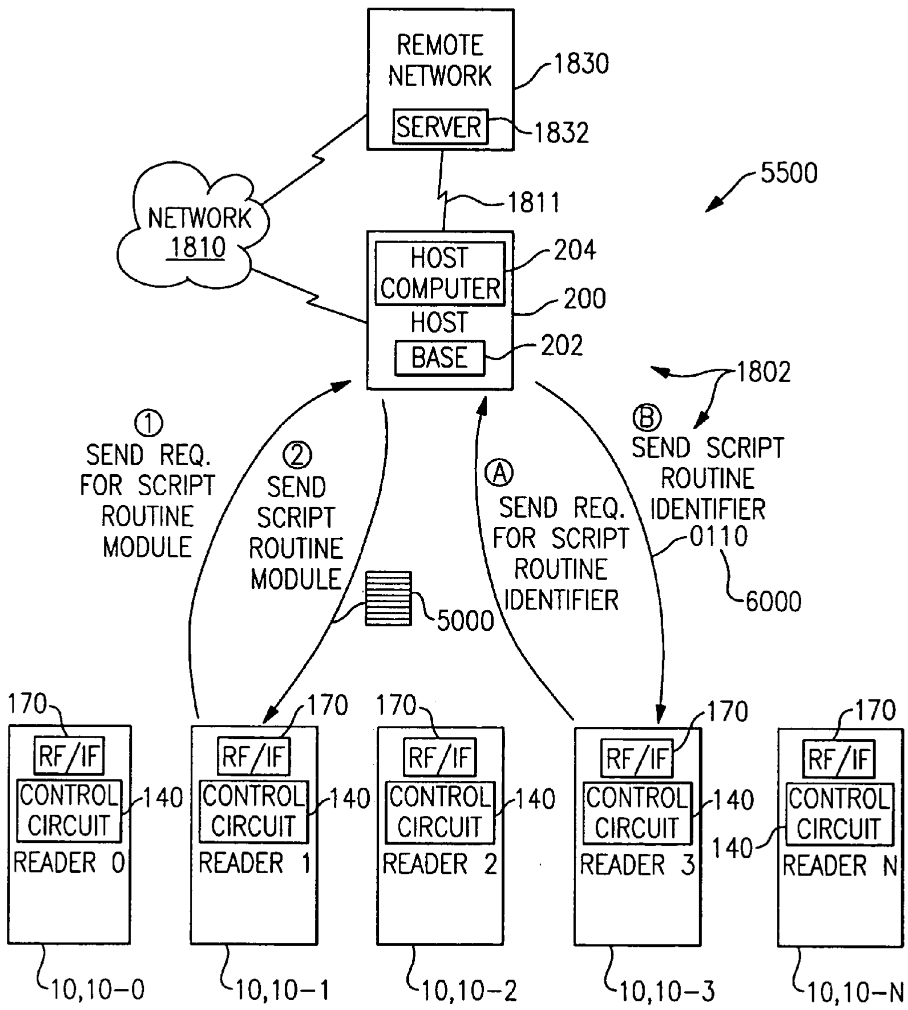

REMOTE NETWORK
SERVER
1830
1832
5500
NETWORK 1810
1811
HOST COMPUTER
204
HOST
200
BASE
202
1802
① SEND REQ. FOR SCRIPT ROUTINE MODULE
② SEND SCRIPT ROUTINE MODULE
Ⓐ SEND REQ. FOR SCRIPT ROUTINE IDENTIFIER
Ⓑ SEND SCRIPT ROUTINE IDENTIFIER
0110
6000
5000
170
RF/IF
CONTROL CIRCUIT
140
READER 0
READER 1
READER 2
READER 3
READER N
10,10-0
10,10-1
10,10-2
10,10-3
10,10-N

FIG.4a

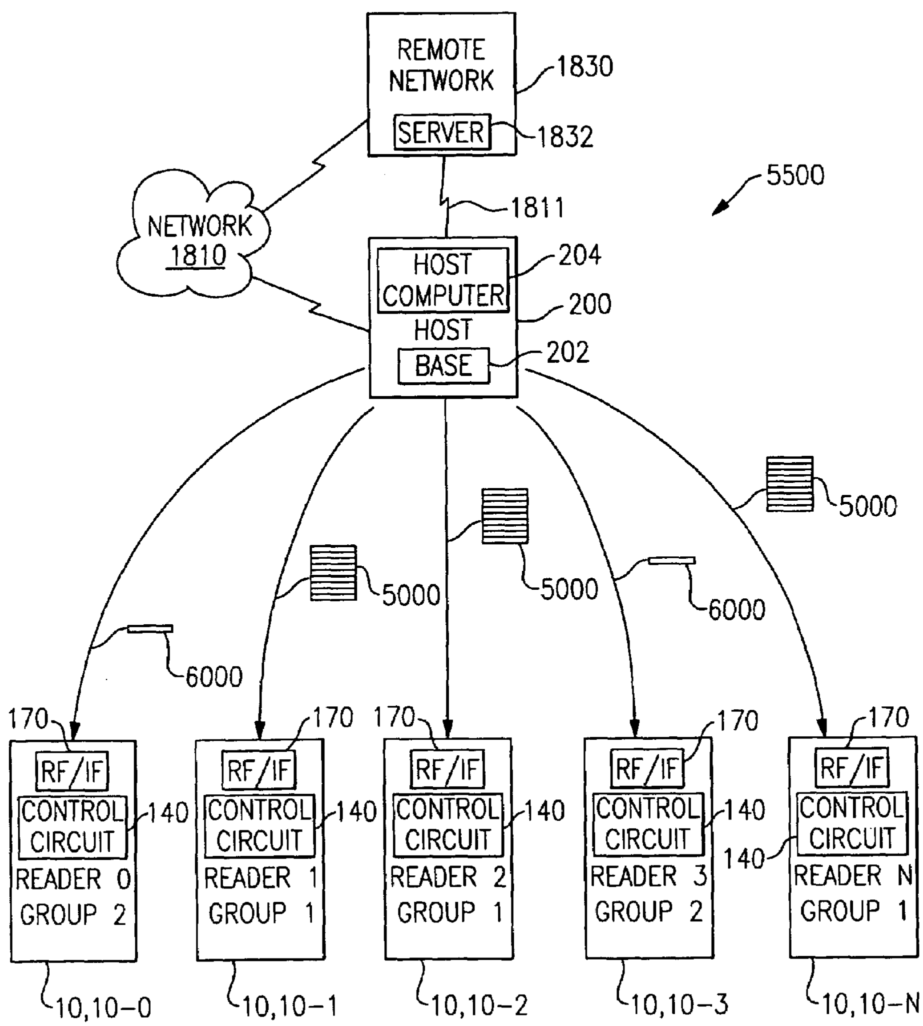

REMOTE NETWORK
1830
SERVER
1832
5500
NETWORK 1810
1811
HOST COMPUTER
204
200
HOST
BASE
202
5000
5000
5000
6000
6000
170
170
170
170
170
RF/IF
CONTROL CIRCUIT
140
READER 0
GROUP 2
READER 1
GROUP 1
READER 2
GROUP 1
READER 3
GROUP 2
READER N
GROUP 1
10,10-0
10,10-1
10,10-2
10,10-3
10,10-N

FIG.4b

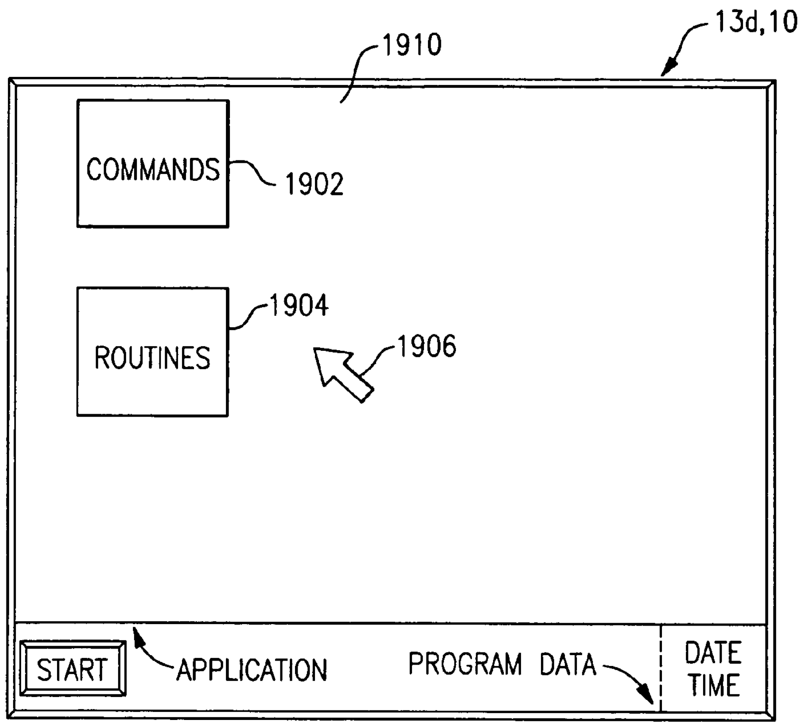

13d,10
1910
COMMANDS
1902
ROUTINES
1904
1906
START
APPLICATION
PROGRAM DATA
DATE
TIME

FIG.5a

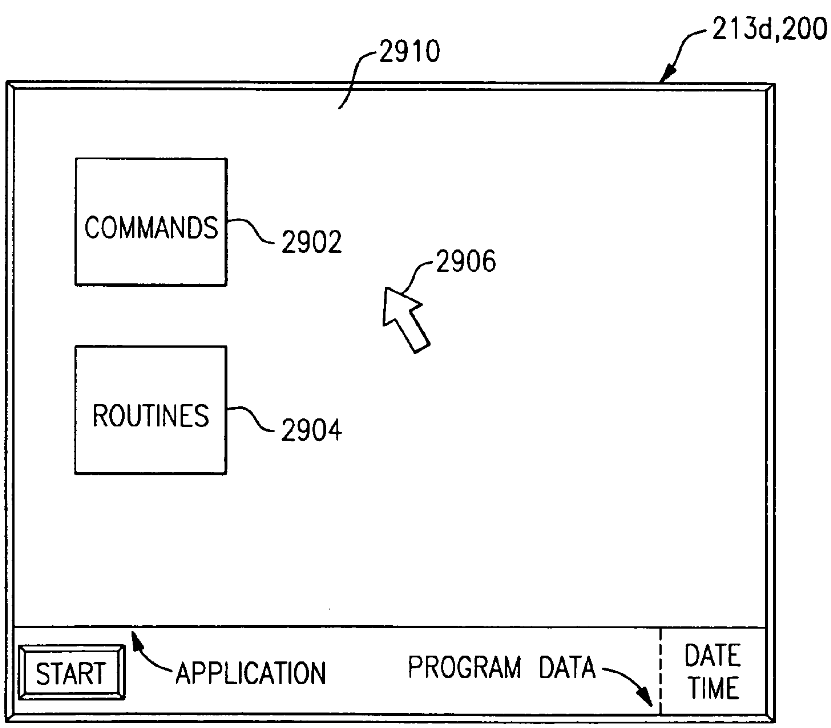
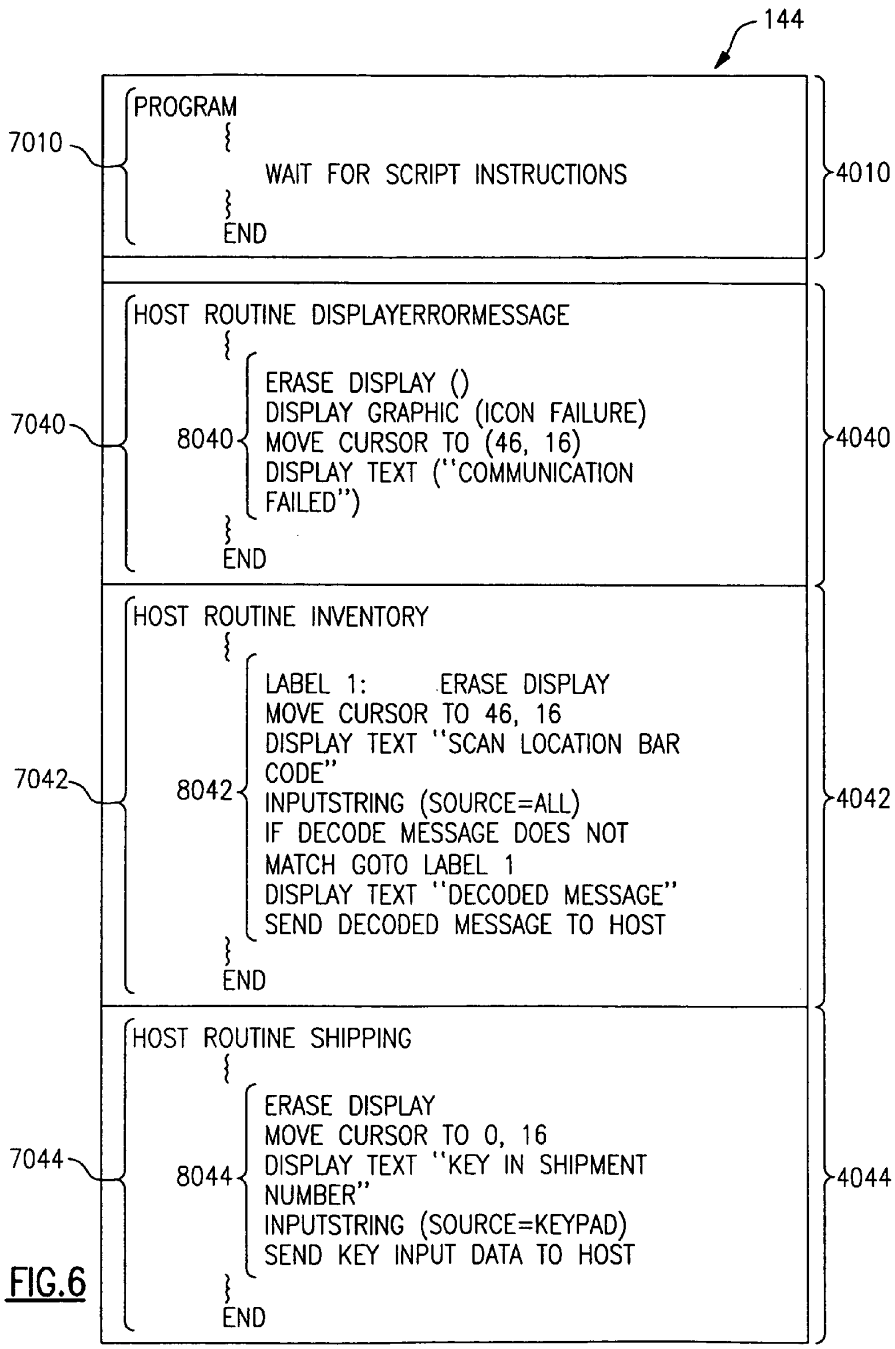
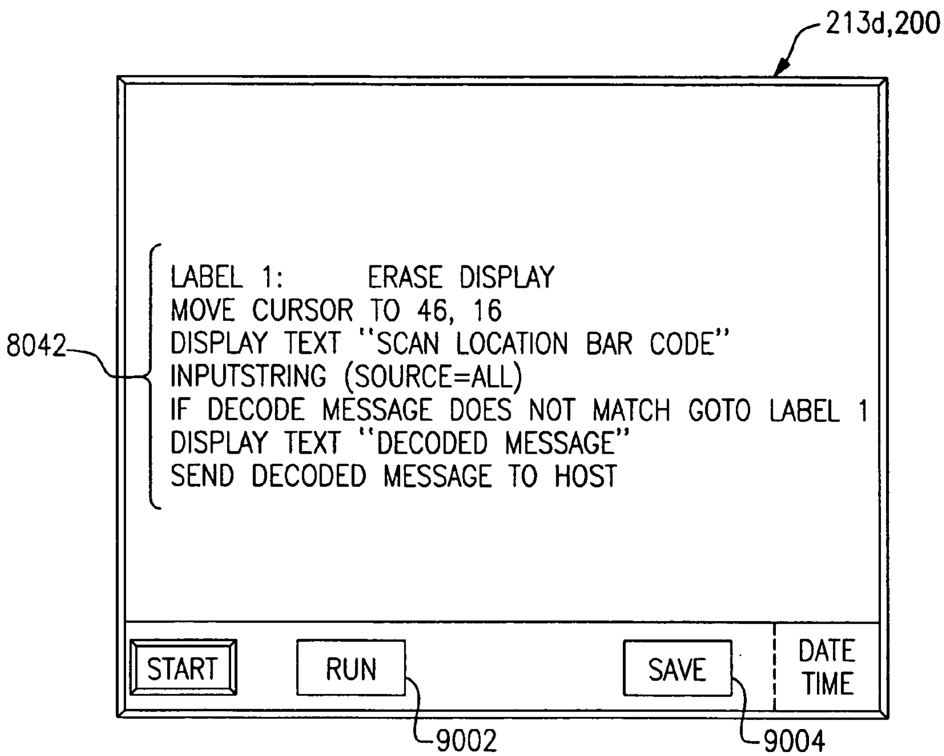

213d,200
2910
COMMANDS
2902
2906
ROUTINES
2904
START
APPLICATION
PROGRAM DATA
DATE
TIME

FIG.5b


144
7010
PROGRAM
{
WAIT FOR SCRIPT INSTRUCTIONS
}
END
4010
7040
HOST ROUTINE DISPLAYERRORMESSAGE
{
8040
ERASE DISPLAY ()
DISPLAY GRAPHIC (ICON FAILURE)
MOVE CURSOR TO (46, 16)
DISPLAY TEXT ("COMMUNICATION FAILED")
}
END
4040
7042
HOST ROUTINE INVENTORY
{
8042
LABEL 1: ERASE DISPLAY
MOVE CURSOR TO 46, 16
DISPLAY TEXT "SCAN LOCATION BAR CODE"
INPUTSTRING (SOURCE=ALL)
IF DECODE MESSAGE DOES NOT MATCH GOTO LABEL 1
DISPLAY TEXT "DECODED MESSAGE"
SEND DECODED MESSAGE TO HOST
}
END
4042
7044
HOST ROUTINE SHIPPING
{
8044
ERASE DISPLAY
MOVE CURSOR TO 0, 16
DISPLAY TEXT "KEY IN SHIPMENT NUMBER"
INPUTSTRING (SOURCE=KEYPAD)
SEND KEY INPUT DATA TO HOST
}
END
4044
FIG.6



213d,200
8042
LABEL 1: ERASE DISPLAY
MOVE CURSOR TO 46, 16
DISPLAY TEXT "SCAN LOCATION BAR CODE"
INPUTSTRING (SOURCE=ALL)
IF DECODE MESSAGE DOES NOT MATCH GOTO LABEL 1
DISPLAY TEXT "DECODED MESSAGE"
SEND DECODED MESSAGE TO HOST
START
RUN
SAVE
DATE
TIME
9002
9004

FIG.7

CUSTOMIZABLE OPTICAL READER

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. application Ser. No. 10/402,885, filed Mar. 28, 2003 now U.S. Pat. No. 6,959,856, entitled "Customizable Optical Reader" which claims the priority of provisional U.S. Application No. 60/368,375, filed Mar. 28, 2002, entitled, "Customizable Optical Reader Having Multiple User Selectable Instruction Execution Protocols." Priority to both of the above applications is claimed and both of the above applications are herein incorporated by reference in their entirety.

FIELD OF THE INVENTION

This invention relates generally to optical readers and specifically to system and methods for reprogramming optical readers.

BACKGROUND OF THE INVENTION

Optical readers tend to fall into one of three categories: wand readers, laser scan engine optical readers and image sensor based optical readers.

Wand readers generally comprise a single light source and single photodetector housed in a pen shaped housing. A user drags the wand reader across a decodable symbol (e.g., a bar code) and a signal is generated representative of the bar space pattern of the bar code.

Laser scan engine based optical readers comprise a laser diode assembly generating a laser light beam, a moving mirror for sweeping the laser light beam across a decodable symbol and a signal is generated corresponding to the decodable symbol.

Image sensor based optical readers comprise multi element image sensors such as CID, CMOS, or CCD image sensors and an imaging optic for focusing an image onto the image sensor. In operation of an image sensor based optical reader, an image of a decodable symbol is focused on an image sensor and a signal is generated corresponding to the signal. Image sensor elements may be arrayed in a line or in a rectangular matrix or area. Area image sensors capture a digital picture and use software algorithms to find and decode one or more symbols.

Users of laser scanner engine based optical readers have been switching in increasing numbers to image sensor based optical readers. Image sensor based optical readers are more durable and offer additional features relative to laser scan engine based bar code readers. Features and functions which have been incorporated into image sensor based optical readers involve image processing.

An image sensor based optical reader having image processing functionality is described in U.S. Pat. No. 6,298,176, issued Oct. 2, 2001, entitled "Symbol-Controlled Image Data Reading System," assigned to the assignee of the present invention and incorporated by reference. In the patent, an optical reader is described which reads an image data reading instruction symbol and which outputs image data which may include signature data in manner that depends on the information encoded in the image reading instruction symbol.

The added functionality possible with optical readers, coupled with reduced costs, have made optical readers attractive to an ever-widening market of users who seek to employ optical readers in an ever-growing variety of applications. Manufacturers of optical readers have been tested in satisfying all of their customer demands for readers, which can satisfy a greater variety of optical reader applications. Accordingly, there is a need for an optical reader which can readily be custom programmed to operate in a manner consistent with a user's particular application.

SUMMARY OF THE INVENTION

According to its major aspects and broadly stated in the invention is a customizable optical reader, which may be programmed in a variety of ways.

In one aspect, the invention includes an optical reader including script interpreter enabling the reader to execute complex and varied commands and strings of commands (which may be referred to as "script routine modules") during execution of a main program.

In another aspect, the invention includes an optical reader, which is operable in a "host commands" mode and a "host routines" mode. In the "host commands" mode, the reader receives and executes a script routine module from a host. In the "host routines" mode the reader receives a script routine module identifier from the host, and the reader, in turn, executes a selected one of a plurality of reader-stored script routine modules based on the identifier.

These and other details, advantages and benefits of the present invention will become apparent from the detailed description of the preferred embodiment and the associated drawings.

BRIEF DESCRIPTION OF THE DRAWING

For a further understanding of these and objects of the invention, reference will be made to the following detailed description of the invention which is to be read in connection with the accompanying drawing, wherein:

FIG. **1***a* is a schematic/physical view of an optical reader network;

FIGS. **1***b*–**1***j* are prospective views of various readers according to the invention;

FIGS. **2***a*–**2***b* are electrical block diagrams of readers according to the invention;

FIGS. **3***a*–**3***b* are memory maps illustrating an implementation of the invention;

FIG. **4***a* is a schematic/flow diagram illustrating an implementation of the invention;

FIG. **4***b* is a schematic/flow diagram illustrating another implementation of the invention;

FIGS. **5***a* and **5***b* illustrate user interfaces which may be utilized in an implementation of the invention;

FIG. **6** is a memory map illustrating further aspects of the invention;

FIG. **7** is an exemplary user interface illustrating further aspects of the invention.

DETAILED DESCRIPTION OF THE INVENTION

An optical reader network **1800** is shown in physical form/schematic view of FIG. **1***a*. Network **1802** at multiple reader work location **3002** may be a local area network (LAN) including a plurality of optical readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N. Each of the readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N is in radio communication with base **202** of host **200**, which, along with host computer **204** make up host **200**. Host **200**, in turn, is in communication with network **1810**. Network **180** may be part of the Internet. However, network

1810 may also be a private network. Through network **1810** host **200** is in communication with customer service center network **1830** which is typically maintained by the supplier and/or manufacturer of readers **10**. Customer service network **1830** may include (e.g., network interface device **1844**, a server **1832**, several personal computers of which computer **1834** is representative, a database **1836** and an authentication module **1842**) which allows only registered users to access the contents of database **1836**. Resident on server **1832** of customer service network **1830** is an internet website allowing users of reader **10** to access information about reader **10** including reader loadable programs and/or program instructions which may be loadable on to readers **10**. Network **1830** may be a local area network (LAN) but often is provided by a wide-area network (WAN) having components spread out over various locations.

Also in communication with network **1810** (and with customer service network **1830** through network **1810**) are readers at work locations other than work location **1804**. At location **1806**, a single reader **10** having a network interface incorporated therein is in communication with network **1810**. At location **3004**, a network **1806** is provided including a single reader **10** in communication with a host **400** in communication with network **1810**. Each communication link of network **1800** may be wired or in the alternative, wireless.

From time to time it is useful to reprogram readers **10-0**, **10-1** **10-2**, **10-3**, **10**-N. For example, if a manufacturer/supplier develops a new software function which may be executed by readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N, it would be beneficial to load that software into readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N. At location **3002**, an application for readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N may change. Readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N may be required to operate to satisfy required functions of a first application and then, a second application. Readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N or a subset of readers **10-0**, **10-1**, **10-2**, **10-2**, **10-3**, **10**-N may be required to satisfy required functions of e.g., a generic (i.e., any customer) inventory application, a generic shipping application, a generic receiving application, a generic point of sale application, a customer-specific shipping application, a customer-specific receiving application or a customer-specific point of sale application. For example, a customer may use readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N 364 days a year in a point of sale operation, and one day a year in an inventory application.

An individual reader (e.g., reader **10-0**) operates at its fastest speed if it does not have to communicate with any other device such as host **200** during execution of a main operating program resident thereon. Thus, a reader (e.g., reader **10-0**) would operate at its fastest possible speed if an operating program, such as a compiled program with no script interpreter, were loaded thereon having all the program routines that were necessary for the operation of the reader in a particular application. However, the installation of a new operating program is often a painstaking, time-consuming process. The individual reader **10** has to be linked to a host **200**, and an entire operating program has to be downloaded into reader **10**, a process that can take at least several seconds, and up to several minutes, and is subject to failure. The reprogramming of each or several readers can be a logistical challenge given that readers are typically distributed at various locations throughout a work location, especially considering that a work location in accordance with the invention can comprise a wide geographic area (e.g., an entire continent or country). If the number of readers, N, is large, it can be seen that full-operating program reprogramming would result in extremely long delays and would perhaps not be worth the effort if a special programming function were needed only for a short duration of time, or for one isolated particular application.

Housings **11** for optical readers in which the invention can be employed are shown in FIGS. **1***b*–**1***j*. In FIG. **1***b*, a gun style optical reader is shown as described in copending application Ser. No. 10/339,275, filed Jan. 9, 2003, entitled "Housing For Optical Reader," incorporated by reference. An imaging module (not shown) is incorporated in the reader housing **11**. In FIG. **1***c*, a gun style reader **10** is shown having an integrated keyboard **13***k* and display **13***d*. In FIGS. **1***d*–**1***e*, a portable data terminal (PDT) style reader is shown having a keyboard **13***k* and a display **13***d*. In FIG. **1***g*, an embodiment is shown wherein display **13***d* includes an associated touch screen overlay and which further includes a stylus **18** for entering signature information. In FIG. **1***g*, a cellular phone reader **10** is shown which has a display **13***d* and keyboard **13***k* and which incorporates an imaging module **50** as is described in U.S. patent application Ser. No. 10/092,789, filed Mar. 7, 2002, entitled, "Optical Reader Imaging Module," incorporated by reference. In the embodiment of FIG. **1***h*, a reader comprises a portable data assistant (PDA). In the embodiment of FIG. **1***e*, reader **10** includes housing **11** configured to be worn on a user's finger. In FIG. **1***j*, reader **10** is in the form factor of a transaction terminal, and includes a card reader **1400**, as is more fully described in U.S. patent application Ser. No. 10/339,444, filed Jan. 9, 2003, entitled "Transaction Terminal Comprising Imaging Module." Numerous other form factors are possible. For example, in the previously incorporated U.S. patent application Ser. No. 10/092,789, filed Mar. 7, 2002, entitled, "Optical Reader Imaging Module," incorporated by reference, a pen style optical reader is shown. In U.S. patent application Ser. No. 09/432,282, filed on Nov. 2, 1999, entitled, "Indicia Sensor System For Optical Reader," incorporated by reference, a reader is shown which rests on a "scan stand."

For a better understanding of the invention, exemplary electrical hardware features of optical readers **10** are described with reference to FIGS. **2***a* and **2***b*.

In FIG. **2***a*, a block diagram of an optical reader electrical circuit is shown having a multi-functional processor IC chip **180** including an integrated frame grabber block **148**. Electrical circuit **100** shown in FIG. **2***a* can be utilized for control of a single 2D imaging module optical reader as is shown for example in U.S. Ser. No. 09/954,081 filed Sep. 17, 2001, entitled "Optical Reader Having Image Parsing Mode," which is hereby incorporated herein by reference in its entirety.

In the specific embodiment of FIG. **2***a*, electrical circuit **100** includes a control circuit **140** comprising CPU **141**, system RAM **142** and system ROM **143** and frame grabber block **148**. Electrical circuit **100** further includes an image sensor **32** typically provided by a photosensitive array and an illumination block **160** having illumination LEDs **16** and aiming LEDs **18** as shown in the physical form view of FIGS. **3***a*–**3***c*. Image sensor **32** of FIG. **2***a* is shown as being provided by a 2D photo diode array. If a 1D image sensor replaces image sensor **32**, then aiming LEDs **18** and illumination LEDs **16** may be constituted by one set of LEDs. In the embodiment shown, image sensor **32** incorporated in an image sensor IC chip **182** which typically further includes an image sensor electrical circuit block **134**. Image sensor electrical block **134** includes control circuit **135** for controlling image sensor **32**, an A/D conversion circuit **136**, for

converting analog signals received from image sensor **32** into digital form and integrated clock **137** sometimes referred to as an oscillator.

In the embodiment shown in FIG. **2***a*, CPU **141** and frame grabber block **148** are incorporated in a multi-functional IC chip **180**, which in addition to including CPU **141** includes numerous other integrated hardware components. Namely, multi-functional IC chip **180** may include a display control block **106**, several general purpose I/O ports **116**, several interface blocks such as a USB circuit block **107** and a UART block **108** for facilitating RS **232** communications, a UART block **109** for facilitating infrared communications (including communication according to standards promulgated by the INFRARED DATA ASSOCIATION® (IrDA®), a trade association for defining infrared standards), and a pulse width modulation (PWM) output block **110**. Multi-functional processor IC chip **180** can also have other interfaces such as a PCMCIA interface **111**, a compact flash interface **112**, and a multimedia interface **113**. Electrical circuit **100** could also include an RF interface **170** in communication with I/O interface **116** providing communication with an external device such as host **200**. If reader **5** includes a display **13***d*, display **13***d* may be in communication with chip **180** via display interface **106**. Trigger **13***t* and keypad **13***k* may be in communication with chip **180** via general purpose I/O interface **116**. Physical form views of readers having displays and keyboards are shown, for example, in U.S. application Ser. No. 10/137,484, filed May 2, 2002, entitled "Optical Reader Comprising Keyboard," which is hereby incorporated herein by reference in its entirety. Multi-functional processor IC chip **180** may be one of an available type of multifunctional IC processor chips which are presently available such as a Dragonball MX1 IC processor chip or a Dragonball MXL IC processor chip available from Motorola, a DSC IC chip of the type available from Texas Instruments, an O-Map IC chip of the type available from Texas Instruments, or a multifunctional IC processor chip of a variety known as Clarity SOCs (e.g., system on a chip) available from Sound Vision, Inc.

In one embodiment, multi-functional processor IC chip **180** comprises components that provide at least the functions provided by a CPU **140**, system RAM **142** and system ROM **143**. In some embodiments, it is advantageous that microprocessor-based decoder module **180** comprises an integrated circuit device having integrated therein a microprocessor, an analog-to-digital converter, a digital-to-analog converter, a direct memory access (DMA) channel, a bi-directional communication line for communication with a sensor such as either or both of line **151** and **152**, and a channel for data receipt from a sensor, such as data line **159** that brings data to frame grabber **148**. The microprocessor-based IC chip **180** can comprise semiconductor materials, optical materials, and photonic bandgap materials. In some embodiments, it is advantageous that the multi-functional processor IC Chip **180** further comprise I/O **116** suitable to accept user input (for example, from a keyboard **13***k*), interface capability for "flash" memory devices such as "Multimedia" (MMC), "Smart Media," "Compact Flash," and "Memory Stick." Other features that may be used to advantage include pulse width modulators (PWMs), serial communication channels (e.g., UARTs, SPIs, and USBs), display drivers and controllers such as for an LCD, wireless communication capability such as Bluetooth and 802.11(a), (b), and (g)-compatible transmitter/receivers, sequence control modules such as timer banks, sensor controllers, audio generators, audio coder/decoders ("codecs"), speech synthesizers, and speech recognition hardware and/or software.

Frame grabber block **148** of IC chip **180** replaces the function of a frame grabbing field programmable gate array (FPGA) as discussed in commonly assigned U.S. patent application Ser. No. 09/954,081, filed Sep. 17, 2001, entitled, "Imaging Device Having Indicia-Controlled Image Parsing Mode," and U.S. patent application Ser. No. 09/904,697, filed Jul. 13, 2001, entitled "An Optical Reader Having a Color Imager," both of which are hereby incorporated herein by reference in their entirety. More particularly, frame grabber block **148** is specifically adapted collection of hardware elements programmed to carry out, at video rates or higher, the process of receiving digitized image data from image sensor chip **182** and writing digitized image data to system RAM **142** which in the embodiment shown is provided on a discreet IC chip. Frame grabber block **148** includes hardware elements preconfigured to facilitate image frame capture. Frame grabber block **148** can be programmed by a user to capture images according to a user's system design requirements. Programming options for programming frame grabber block **148** include options enabling block **148** to be customized to facilitate frame capture that varies in accordance with image sensor characteristics such as image sensor resolution, clockout rating, and fabrication technology (e.g., CCD, CMOS, CID), dimension (1D or 2D), tonality (from 1 to N-bits), color (monochrome or color), biometric features, such as fingerprints, retinal patterns, facial features, and one-and two-dimensional patterns that can provide information, such as chromatography patterns and electrophoretic patterns of mixtures of substances, including substances such as biological samples comprising DNA. A decoder board that automatically adapts itself to satisfy the image capture requirements of a presently attached image sensor is described in U.S. patent application Ser. No. 10/339,439, filed Jan. 9, 2003, entitled, "Decoder Board For An Optical Reader Utilizing A Plurality Of Imaging Formats," incorporated by reference. Aspects of the operation of circuit **100** when circuit **100** captures image data into RAM **140** are now described. Circuit **100** can perform a cycle of receiving a frame of image data, performing internal programming functions, and decoding the frame of image data in a time period of less than or equal to a second. In a more preferred embodiment, the circuit **100** performs the cycle in a time period of less than or equal to 1/30 of a second. It is expected that in a still more preferred embodiment, the time period can be less than or equal to 1/270 of a second. When trigger **13***t* is pulled, CPU **141**, under the operation of a program stored in system ROM **143**, writes an image capture enable signal to image sensor chip **182** via communication line **151**. Line **151**, like the remainder of communication lines described herein represents one or more physical communication lines. In the embodiment shown, wherein image sensor chip **182** is of a type available from IC Media Corp., I^2C interface **115** of chip **180** is utilized to facilitate communication with chip **182** (if another image sensor chip is selected another type of interface e.g. interface **116** may be utilized). Other types of signals may be sent over line **151** during the course of image capture. Line **151** may carry, for example, timing initialization, gain setting and exposure setting signals.

When control block **135** of image sensor chip **182** receives an image capture enable instruction, control block **135** sends various signals to frame grabber block **148**. Image sensor control block **135** typically sends various types of synchronization signals to frame grabber block **148** during the course of capturing frames of image data. In particular, control block **135** may send to frame grabber block **148**

"start of frame signals" which inform frame grabber block **148** that chip **182** is ready to transmit a new frame of image data, "data valid window" signals which indicate periods in which a row of image data is valid, and "data acquisition clock" signals as established by clock **137** controlling the timing of image data capture operations. In the embodiment described, line **152** represents three physical communication lines, each carrying one of the above types of signals. In an alternative embodiment, vertical and horizontal synchronization signals are processed by frame grabber **148** to internally generate a data valid window signal. Frame grabber block **148** appropriately responds to the respective synchronization signals, by establishing buffer memory locations within integrated RAM **149** of block **148** for temporary storage of the image data received from image sensor chip **182** over data line **159**. At any time during the capture of a frame of image data into system RAM **142**, buffer RAM **149** of frame grabber block **148** may store a partial (e.g., about 0.1 to 0.8) or a full line of image data.

Referring to further aspects of electrical circuit **100**, circuit **100** includes a system bus **150**. Bus **150** may be in communication with CPU **141** via a memory interface such as EIM interface **117** of IC chip **180**. System RAM **142** and system ROM **143** are also connected to bus **150** and in communication with CPU **141** via bus **150**. In the embodiment shown, RAM **142** and ROM **143** are provided by discreet IC chips. System RAM **142** and system ROM **143** could also be incorporated into processor chip **180**.

In addition to having system RAM **142**, sometimes referred to as "working" RAM, electrical circuit **100** may include one or more long-term storage devices. Electrical circuit **100** can include for example an "flash" memory device **120**. Several standardized formats are available for such flash memory devices including: "Multimedia" (MMC), "Smart Media," "Compact Flash," and "Memory Stick." Flash memory devices are conveniently available in card structures which can be interfaced to CPU **141** via an appropriate "slot" electromechanical interface in communication with IC chip **180**. Flash memory devices are particularly useful when reader **5** must archive numerous frames of image data. Electrical circuit **100** can also include other types of long term storage such as a hard drive which may be interfaced to bus **150** or to an appropriate I/O interface of processor IC chip **180**.

In a further aspect of electrical circuit **100**, control circuit **140** is configured to control the turning off and turning on of LEDs **16**, **18** of illumination block **160**. Control circuit **140** preferably controls illumination block **160** in a manner that is coordinated with the capturing of the frames of image data. Illumination LEDs **16** are typically on during at least a portion of frame capture periods. Configuring circuit **140** so that LEDs **16**, **18** have off periods significantly reduces the power consumption of circuit **100**.

In a further aspect of the electrical circuit **100**, electrical circuit **100** can be configured so that PWM output interface **114** of IC chip **180** controls illumination LEDs of an imaging module such as illumination LEDs **16** of module **10-1** or aiming/illumination LEDs **18** of module **10-2**.

In one embodiment, illumination block **160** is in communication with PWM output interface **114** and configured in such manner that LEDs **16** are turned on at a leading edge of PWM pulses output at PWM interface **114**, and are turned off at falling edges of PWM pulses output at PWM interface **114**. PWM interface **114** should be configured so that several pulses are generated and sent over communication line **153***i* during the time that a single row of pixels of image data are exposed to light prior to clocking out of pixel values corresponding to that row. Thus, illumination LEDs **16** would be turned on and off several times during the exposure period for exposing a row of pixels to light. Further, the number of pulses output by PWM output **114** during the time that a single row of pixels are exposed should not vary substantially from row to row. The pixel clock signal received at frame grabber block **148** of IC chip **180** can be utilized to generate the PWM output. It can be seen, therefore, that multifunctional IC chip **180** including frame grabber block **148** and PWM output **114** greatly simplifies the task of developing PWM signals for use in controlling illumination LEDs **16** of module **10**.

In another embodiment, PWM output **114** and illumination block **160** are configured so that PWM output **114** controls the intensity of illumination, not the on time/off time of illumination. Illumination LED block **160** in such an embodiment can include a power supply circuit which is interfaced to PWM output **114** such that the PWM signal output at PWM output **114** varies the voltage or current supplied to LEDs **16**.

In a further aspect of electrical circuit **100**, aiming LEDs **18** of circuit **100** can be controlled by a signal transmitted by a general purpose I/O port **116** of IC chip **180** over communication line **153***a*. Multifunctional processor IC chip **180** can be programmed so that an aiming LED control signal is caused to change to an "ON" state when frame grabber block **148** completes the process of capturing a complete frame of image data. Frame grabber block **148** may be configured to generate an "end of acquisition" or "end of frame" signal when frame grabber block **148** completes the process of capturing a complete frame of image data into RAM **142**. When CPU **141** receives an "end of acquisition" signal, CPU **141** controls I/O port **116** to change the state of an LED control signal. Control circuit **140** may also change the state of an LED control signal when generating a start of frame signal. Control circuit **140** may execute a delay prior to changing the state of an LED signal. Control circuit **140** is programmed so that an LED control signal remains in an "ON" state known to be sufficiently short duration so as not to cause actuation of an aiming LED **18** during a succeeding frame exposure period. Configured in the manner described, aiming LEDs **18** are selectively pulsed on for a short duration during intermediate successive frame exposure periods, e.g. frame exposure periods.

Referring now to FIG. **2***b*, electrical circuit **101** is described. Electrical circuit **101** controls operation of a single imaging module optical reader comprising a low cost 1D CCD image sensor **32** incorporated on IC chip **183**. Image sensor **32** of FIG. **2***b* may be provided for example by a Toshiba Model TCD 1304 AP linear image sensor. Further aspects of an exemplary ID imaging module are described, for example, in application Ser. No. 09/658,811, filed Sep. 11, 2000, entitled "Optical Assembly for Barcode Scanner," which is hereby incorporated herein by reference in its entirety.

Referring to aspects of electrical circuit **101** in detail, electrical circuit **101** includes a control circuit **140** which, like control circuit **140** of circuit **100** is partially incorporated in a multifunctional processor IC chip **180** including CPU **141** and a frame grabber block **148**. Control circuit **140** of circuit **101** further includes system RAM **142** system ROM **143** and supplementary central processor unit (CPU) **147**, integrated on processor IC chip **179**. System RAM **142** and system RAM **143** are in communication with EIM interface **117** of IC chip **180** via bus **150**.

Processor IC chip **179** provides control and timing operations similar to that provided by electrical block **134** of

image sensor chip **182** described in FIG. **1***a*. Processor IC chip **179**, in general, sends synchronization signals and digital clocking signals to IC chip **180**, and sends digital clocking signals to A/D conversion circuit **136** and image sensor **32**. Processor IC chip **179** of circuit **101** may be a relatively low power processor IC chip such as an 8-bit Cypress Programmable System-on-Chip™ (PSOC™) CY8C26Z33-24PZI Microcontroller processor IC chip available from Cypress MicroSystems of Bothell, Wash. Aspects of the operation of IC chip **179** in during the course of capturing slice image data will now be described in detail. When trigger **13***t* is pulled, CPU **141** transmits enable image capture instructions over communication line **151**. However, a user defined script instruction or module (a set of script instructions) when executed by reader **10**, may override such a normal functioning of trigger **13***t* as a capture enable actuation. In response to receipt of an image capture enable instructions received from chip **180**, processor IC chip **179** performs a variety of operations. Processor IC chip **179** may send synchronization signals, such as "start of scan," "data valid window," and "data acquisition clock" signals to frame grabber block **148** via communication line **152**. Processor IC chip **179** may also send timing signals and digital clocking signals (e.g. master clock, integration clear gate, and shift gate pulse) to image sensor **32**. Processor IC chip **179** typically also transmits a master clock signal to A/D conversion circuit **136**. Referring to further aspects of IC chip **180** of circuit **101**, CPU **141** of chip **180**, may also send e.g. gain setting, exposure setting, and timing initialization signals via line **151** to IC chip **179**. Communication between IC chip **180** and IC chip **179** may be made via an SPI interface or I/O interface **116** of chip **180** and chip **179**.

As will be explained with reference to circuit **104**, shown in FIG. **2***e*, processor IC chip **179** may be replaced by a programmable logic circuit, e.g. a PLD, CPLD, or an FPGA. IC chip **179** could also be replaced by an ASIC. Electrical circuit **101** of FIG. **2***b*, includes what may be termed a "digital digitizer" in that analog voltage levels transmitted by CCD image sensor **32** on line **155** are converted into gray scale pixel values by A/D converter **136** and transmitted via line **159** to frame grabber block **148**. Circuit **101** could also include an analog digitizer which processes an analog signal generated by image sensor **32** to generate a two-state output signal that changes state in accordance with light-to-dark and dark-to-light transitions of the image sensor analog output signal.

Processor IC chip **179** also controls LED bank **160**. LED bank **160** of a 1D image sensor reader typically includes a single bank of LEDs, which simultaneously illuminates a target area and provides an aiming pattern facilitating aligning of the reader with a target indicia.

Reader memory **144** of circuit **100** and of circuit **101** in the specific embodiments of FIGS. **2***a* and **2***b* includes system RAM **144**, program ROM **143**, on-board RAM **149**, and flash memory **120**.

In embodiments described, reader **10** includes an imaging assembly including an image sensor having a plurality of photosensors and an aiming/illumination system having LEDs **16**, **18**. In the alternative, an imaging assembly of reader **10** could be wand style (e.g., including a single photodetector and light source assembly which is manually moved across a target) or laser scan image engine based (e.g., including (a) a laser diode assembly generating a laser beam which is automatically swept across a target, and (b) a single photodetector). Referring now to particular aspects of the invention, a reader, according to the invention, includes a script/interpreter programming architecture. In a

script/interpreter programming architecture, as is explained with reference to the memory map diagram of FIG. **3***a*, an interpreter **4004** is resident in address locations **4006** of memory **144** as part of a main operating program or "kernel". As will be explained in more detail herein, reader **10** may be programmed to wait for a script instruction or script routine module to be received from host **200**. When the script instruction routine module is received from host **200**, interpreter **4004** interprets the module and control circuit **140** executes the module. Control circuit **140** executes instruction of the script routine module without compiling the instruction of the script routine module together with the remaining instructions that make up of kernel **4008**. During execution of the instructions that make up a script execution section, control circuit **144** executes a script routine module, a set of instructions that are not part of kernel **4008**, which are interpreted by interpreter **4004**, and which do not have to be compiled together with the remaining instructions that make up kernel **4008** prior to execution. Typically memory **144** further includes a scratch memory **4016** taking up address locations **4018**. Scratch memory **4016** can serve a variety of useful purposes. For example, as a storage area for script routine modules received by reader **10** to be interpreted by interpreter **4004**.

The establishing of a script/interpreter programming architecture greatly enhances the versatility of optical reader **10**. Because control circuit **140** can execute script instructions, the functionality of reader **10** can be altered greatly without requiring that an entire new operating program be downloaded into reader **10**. The functionality of reader **10** can be changed simply by making available to reader **10** a script routine module **5000** (FIG. **4**) executable by control circuit **140** during execution kernel **4008**. The script routine module executed by reader **10** may be changed depending on the present application requirements of reader **10**. By allowing a customer to author and execute custom script instructions, the software architecture of FIGS. **3***a* and **3***b* frees the manufacturer/supplier who maintains network **1802**, from having to rewrite the code operating on reader **10** each time a customer's application changes.

Referring to a further aspect of the invention, control circuit **140** is operable in a "host commands" mode and "host routines" mode. In the "host command mode", control circuit **140** executes a script routine module received from host **200** when executing the instructions of kernel **4008**. In the "host routines" mode, control circuit **140** executes a script routine module resident in reader memory **144** when executing the instructions of kernel **4008**. The reader is also operable in a "scanner resident" mode, which may also be termed a "reader resident" mode. In a scanner resident mode, control circuit **140** executes a main operating program which has been compiled and loaded onto reader **10**. When executing a main operating program in a scanner resident mode, control circuit **140** does not receive any script instruction, script routine module, or script routine module identifier when executing instruction of the main operating program or kernel. The software architecture of the operating program of a reader **10** in the scanner resident mode may be of the script/interpreter type as described or else may be of another type (e.g., a fully compiled program without interpreter).

Steps executed by a reader operating in the respective "host commands" mode and in the "host routines" mode are described in greater detail with reference to the flow/block diagram **5500** of FIG. **4**. Reader **10-1** of diagram **5500** is

depicted as operating in a "host commands" mode while reader **10** of diagram **5500** is depicted as operating in a "host routines" mode.

At step **1** in a "host commands" mode, control circuit **140** sends a request to host **200** requesting that host **200** send to reader **10-1** a script routine module **5000**. Host **200**, in turn, at step **2**, compiles a script routine module comprising a plurality of script instructions, and sends the script routine module **5000** to reader **10-1**. Interpreter **4004** of reader **10-1** then interprets the script routine module and control circuit **140** executes the script routine module **5000**. Alternatively, control circuit **140** in a "host command" mode may be programmed to wait for a script routine module to be received from host **200**, rather than request that a host **200** send a script routine module, as indicated by step (**1**). In other words, step (**1**) can be deleted.

At step A in the "host routines" mode, control circuit **140** of reader **10-3** sends a request to host **200** requesting that host **200** send reader **10** a script routine module identifier **6000**. Host **200**, in turn, at step B, sends reader **10** an identifier **6000** identifying which of a plurality of script routine modules resident in memory **144** should execute. Reader **10-3**, in turn, executes a script routine module corresponding to identifier **6000** sent by host **200**. The word length of the identifier sent by host **200** in the "host routines" mode need only be a fraction (e.g., 1/10th) of the word length of the script routine module sent by host **200** in the "host commands mode." Accordingly, it is seen that selection of the "host routines" mode reduces possible data collisions and speeds up operation of the reader **10-3** and/or network. Control circuit **140** in the "host routines" mode may be programmed to wait for script routine module identifier to be received from host **200**.

A memory map of a reader operating according to a "host routines" mode in one embodiment is shown in FIG. **3***b*. At address locations **4010** memory **144** includes kernel **4008** having an interpreter **4004**. At memory address locations **4030**, memory **144** includes pointers **4032**, and at memory locations **4040**, **4042**, **4044**, **4046** memory **144** includes a plurality of discrete script routine modules **4050**, **4052**, **4054**, **4046** each selectable by establishing of an appropriate program pointer. In the embodiment described with reference to FIG. **3***b*, control circuit **140**, while operating in the "host routines" mode, establishes a pointer to install an appropriate one of script routine modules **4050**, **4052**, **4054**, **4056** so that the selected script routine module **4050** corresponds with the identifier received from host **200**. Prior to their loading in reader memory **144**, modules **4050**, **4052**, **4054**, **4056** may be authored by a user host computer **204**. Host computer **204** may have programmed thereon a program builder toolkit for use in building modules **4050**, **4052**, **4054**, **4056**.

The modes of operation of reader **10** are selected by a user via a user interface **1910**. The user interface can comprise displayed icons displayed on reader display **13***d* of reader **10** as depicted in FIG. **5***a*. Icons **1902**, **1904** can be displayed as part of graphical user interface **1901** in which a pointer device (e.g., trackball, mouse) is used to move an arrow **1906** over a desired icon, and the actuated to effect selection of the mode corresponding to the icon. In a highly useful embodiment of the invention, the user interface utilized to select between the "host command mode" and the "host routines" mode is a user interface incorporated on host **200**. Host **200** can include a user interface such as a graphical user interface **2910** as is indicated by FIG. **5***b*. Further, host **200** can be in communication with a plurality of readers (e.g., readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N) and can be configured such that actuation of a user interface, (e.g., one of icon, e.g., icon **2902**) results in each of the several readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N being programmed in accordance with the same operating mode. Thus, actuation of "host commands" mode icon **240** results in each of readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N being programmed to operate on a host commands mode. Likewise, actuation of "host routines" icon **2904** result in each of readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N being reprogrammed in a "host routines" mode. Another type of user interface can be used. For example, network **1802** can be configured so that actuation of an appropriate keyboard **13***k* or **213***k* selects a mode of operation. Host **200** can also be programmed so that an actuation of a user initiated command or commands, results in readers of a particular "application group" which may be a subset of the N readers in a network, being programmed in the same way. Application groups are described in U.S. Pat. No. 6,161,760, filed Sep. 14, 1998, entitled "Multiple Application Multiterminal Data Collection Network". For example, host **200** may be utilized to program Application Group **1** to operate in a "host command" mode and Application Group **2** to operate in a "host routines" mode. If readers **10-1**, **10-2**, and **10**-N have been programmed to be part of Application Group **1**, and readers **10-0**, **10-3** have been programmed to be part of Application Group **2**, network **1802** will take on characteristics as illustrated with reference to FIG. **4***b*, wherein host **200** sends readers of Group **1** (readers **10-1**, **10-2**, **10**-N) script routine modules **5000** (sets of script instructions) for execution by control circuit **140** of the reader, and wherein host **200** sends readers of Group **2** (readers **10-0**, **10-3**) identifiers **6000** for identifying at least one of a reader-resident script routine module is to be executed.

The benefits of the respective "host commands" and "host routines" modes of operation of reader **10** will be appreciated as will the benefits of having both of the modes available together.

The "host commands" mode is most useful where host control over operation of several readers **10** is at a premium. Suppose a specific script routine module **5000** must be executed by readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N for only one hour of operation. The script routine module **5000** could be developed using computer **1834** at customer service network **1830** and made available at website of server **1832**. A customer could then download the script routine module **5000** to host **200** via network **1810** or direct link **1811** (FIG. **4**) and contemporaneously, each of several readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N presently in communication with host could be programmed to operate in a "host commands" mode by actuation of icon **2902** or another suitable program method. Each of readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N, when executing the instruction of kernel **4008**, will execute the script routine module created at customer service network **1830**. The "host commands" mode (a) provides for complete control by host **200** of reader operation and (b) eliminates the need to send compiled program codes to each of several readers, (e.g., readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N). To change the operation of each of several readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N, all that is needed is a change in a script routine module that is resident in host **200** and available for sending to each of several readers.

The "host routines" mode is most useful where speed is at a premium, and yet host control over operation of several readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N is desired. When several readers operate in a "host routines" mode, host **200** maintains control over the operation of several readers, but

only selects from preset script routine modules resident in the several readers (e.g., readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N).

In a useful embodiment of the "host routines" mode, control circuit **140** can be configured to execute a string of script routine modules in succession. More specifically, memory **140** can include a plurality of script routine modules, **4050**, **4052**, **4054**, **4056**, and can be configured to execute two or more of the modules in succession in any selected order to define a function different than the function that is defined by control circuit **140** executing a single one of the modules. Accordingly, if a specific function was required of readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N for only one hour of operation, personnel utilizing computer **1834** (such as engineers employed by the manufacturer of reader **10**) at customer service center network **1830** could identify a string of subroutine modules within readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N which, when executed together in succession, satisfied the required function. For example, modules **4050**, **4052**, **4056** executed in the order of (1) **4050**; (2) **4056**; (3) **4050**, could define a new function. From the string of script routine modules, a corresponding string of identifiers could be created and transmitted from computer **1834** to host **200** via network **1810**. A user of host **200** could reprogram all of readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N in communication thereto in accordance with a "host routines" mode operation simply by actuation of routines icon **2904** as depicted in FIG. **5***b*. Operating in accordance with the host routines mode, all of readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N would execute a string of script routine modules identified at customer service network **1830** as being capable of performing the required custom-made function.

The availability of both of the "host commands" mode and the "host routines" modes allows readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N to be customized to the end that the needs of a customer can be satisfied. If a customer demands high accuracy, a highly specialized operating routine, and a host control of operation of one or more reader, the "host commands" mode can be selected. If a customer demands high-speed operation in a custom developed application, the "host routines" mode can be selected. If one of the modes of operation fails to satisfy the needs of a customer, the other mode of operation can be tried. For example, if during the course of operation in the "host routines" mode it is found that one or more of readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N configured to operate in the mode had not previously been updated to include thereon all of the script routine modules **4050**, **4052**, **4054**, **4056** specified by the script routine module identifier **6000** or identifier string sent by host **200** to reader **10**, or if a required reader function cannot be satisfied by selection of one or more script routine modules resident on a reader, a user may select the "host commands" mode of operation so that all of the readers **10-0**, **10-1**, **10-2**, **10-3**, **10**-N satisfy the required function.

An example of the invention is described with reference to the correspondence memory map of FIG. **6** in which various sections of pseudocode corresponding to an exemplary kernel and exemplary script routine modules are shown in association with the memory map originally described relative to FIG. **3***b*.

In the example of FIG. **6**, a kernel utilizing address locations **4010** may simply wait for script instructions or a script routine module (a series of script instructions) as is indicated by one-line pseudocode program **7010**.

Referring to further aspects of the memory map of FIG. **6**, address locations **4040** may contain a script routine module for displaying a particular error message on display **13***d* as is indicated by pseudocode **7040**. Further address locations **4042** may contain a script routine module for conducting an inventory application as is indicated by pseudocode **7042**. Still further, address locations **4044** may contain a script routine module for conducting a shipping application as is indicated by pseudocode **7044**.

In "host commands" mode, control circuit **140** of one or several like programmed readers interprets and executes a string of script instructions, (i.e., script routine modules **5000** received from host **200**). For example, control circuit **140** of one or several like programmed readers, when operating in a "host commands" mode, may execute a string of instructions such as instructions corresponding to pseudocode **8040** or pseudocode **8042**, or an entirely different script routine module customer authored by a user utilizing host **200** or reader **10**. It is understood that when instructions corresponding to pseudocode **8040**, pseudocode **8042**, and pseudocode **8044** are executed by control circuit **140**, various built in firmware functions of control circuit **140** are executed.

In addition to or as part of the GUI driver menu selector interface described relative to FIGS. **5***a* and **5***b*, reader **10** may be driven into "host routines" mode by the sending of a specialized script instruction from host **200** to reader **10**. Specifically, identifier **5000** may comprise a script instruction including pointer information, which is interpreted and executed by control circuit **140** to select and execute a selected one of the script routine modules, which has been loaded into the memory locations **4040**, **4042**, **4044**. An identifier **5000**, for example, may comprise the compiled data corresponding to the pseudocode script instruction EXECUTE (INVENTORY). On receipt of the identifier, reader **10** executes the corresponding script routine module, which in the example of FIG. **6**, corresponds to pseudocode **7042**.

Referring to the user interface of FIG. **7**, a user may build a script routine module utilizing an appropriate toolkit and GUI interface loaded onto host **200**. When a user has authored a program in a user understandable language as in the pseudocode **8042** of FIG. **7**, the user may select various control buttons. For example, actuation of RUN button **9002** may result in the authored program being compiled and formatted for sending to reader **10** or several readers **10** for interpretation and execution by reader **10** or several readers **10**. Actuation of SAVE button **9004** may result in the authored program represented by pseudocode **9002** being compiled, formatted and loaded into a designated script routine module memory location of a reader **10** or readers **10** (e.g., location **4042**) so that the program is executed by reader **10** when reader **10** operates in a "host routines" mode as described herein.

While the present invention has been particularly shown and described with reference to the preferred mode as illustrated in the drawing, it will be understood by one skilled in the art that various changes in detail may be effected therein without departing from the spirit and scope of the invention as defined by the claims.

We claim:

1. A method to create a custom function in an optical reader comprising the steps of:

providing a hand held optical reader having a host routines mode and a plurality of script routine modules;

providing a host computer to communicate with the optical reader;

providing a computer to order script routine modules into lists that can be executed in succession by the optical reader;

identifying a string of the script routine modules using the computer such that when said string of script routine modules are executed together in succession said string of script routine modules define a function;

generating a string of identifiers representing the string of script routine modules on the computer;

transmitting the string of identifiers from the computer to the host computer;

transmitting the string of identifiers from the host computer to one or more optical readers set to the host routines mode; and

executing the custom function on at least one of the optical readers as the execution order of a selected list of script routine modules.

2. The method of claim **1**, to create a custom function wherein the step of identifying a string of the script routine modules comprises identifying a string of the script routine modules using the computer such that when the script routine modules are executed together in succession said string of script routine modules define a function to display a particular error message on an optical reader display.

3. The method of claim **1**, to create a custom function wherein the step of identifying a string of the script routine modules comprises identifying a string of the script routine modules using the computer such that when the script routine modules are executed together in succession said string of script routine modules define a function to conduct an inventory application.

4. The method of claim **1**, to create a custom function wherein the step of identifying a string of the script routine modules comprises identifying a string of the script routine modules using the computer such that when the script routine modules are executed together in succession said string of script routine modules define a function to conduct a shipping application.

5. The method of claim **1**, to create a custom function wherein the step of transmitting the string of identifiers from the host computer to one or more optical readers comprises transmitting the string of identifiers from the host computer to one or more optical readers set to the host routines mode wherein the script routine modules identified by the string of identifiers are resident in the one or more optical readers.

6. The method of claim **1**, to create a custom function wherein the step of executing the custom function comprises executing the custom function on at least one of the optical readers as the execution order of a selected list of script routine modules wherein a control circuit within the optical reader executes the script routine modules resident in a memory in the optical reader.

7. The method of claim **6**, to create a custom function wherein the step of executing the custom function comprises executing the custom function on at least one of the optical readers as the execution order of a selected list of script routine modules wherein a control circuit within the optical reader executes script routine modules resident in a memory in the optical reader and the control circuit selects each successive script routine modules by use of a program pointer.

8. The method of claim **1**, to create a custom function further comprising the step of sending a request to the host computer requesting the script identifiers before the step of transmitting the string of identifiers from the host computer.

9. A method to create a custom function in an optical reader comprising the steps of:

providing a hand held optical reader having a host command mode;

providing a host computer to communicate with the optical reader and to send one or more script routine modules to the optical reader set to the host command mode;

identifying one or more script routine modules to be transmitted to the optical reader;

transmitting the one or more script routine modules from the host computer to one or more optical readers set to the host command mode such that the script routine modules are executed together in succession by the optical reader as a custom function; and

executing the custom function on at least one of the optical readers.

10. The method of claim **9**, to create a custom function wherein the step of providing a hand held optical reader comprises providing a hand held optical reader having a host command mode and a control circuit.

11. The method of claim **10**, to create a custom function further comprising the step of sending a request to the host computer to send a script routine module to the reader before the step of transmitting the one or more script routine modules.

12. The method of claim **9**, to create a custom function wherein the step of providing a hand held optical reader comprises providing a hand held optical reader having a host command mode, a control circuit, and an interpreter.

13. The method of claim **12**, to create a custom function wherein the step of executing the custom function comprises executing the custom function on at least one of the optical readers by interpreting the one or more script routine modules in the optical reader using the interpreter, and executing the interpreted script routine modules with the control circuit to perform the custom function.

14. The method of claim **13**, to create a custom function wherein the step of executing the custom function comprises executing the custom function on at least one of the optical readers by interpreting the one or more script routine modules in the optical reader using the interpreter, and executing the interpreted script routine modules with the control circuit by further executing one or more firmware functions built into optical reader to perform the custom function.

15. The method of claim **9**, to create a custom function wherein the step of identifying the one or more script routine modules comprises identifying the one or more script routine modules to be transmitted to the optical reader in the host command mode following an unsuccessful attempt to create the custom function using a host routines mode wherein one or more of the needed script routine modules is not resident in the optical reader.

16. The method of claim **15**, to create a custom function wherein the step of identifying the one or more script routine modules comprises identifying the one or more script routine modules to be transmitted to the optical reader in the host command mode following an unsuccessful attempt to create the custom function using a host routines mode wherein one or more of the needed script routine modules is not resident in the optical reader, and after the needed script routine modules are loaded into the reader in the host command mode and after the reader is returned to the host routines mode, a pointer is established to associate each of the selected script routine modules with an identifier.

17. The method of claim **9**, to create a custom function wherein the step of identifying the one or more script routine modules comprises identifying the one or more script routine modules to be transmitted to the optical reader to display a particular error message on an optical reader display.

18. The method of claim **9**, to create a custom function wherein the step of identifying the one or more script routine modules comprises identifying the one or more script routine modules to be transmitted to define a function to conduct an inventory application.

19. The method of claim **9**, to create a custom function wherein the step of identifying the one or more script routine

modules comprises identifying the one or more script routine modules to be transmitted to the optical reader to define a function to conduct a shipping application.

20. A hand held optical reader including:

a control circuit configured to control an image sensor and including a memory, a processor and firmware and where said processor is configured to execute instructions stored within said memory and said firmware;

a main operating program including a plurality of said instructions configured for execution by said processor;

a script interpreter program including a plurality of said instructions configured for execution by said processor, said script interpreter program is configured to interpret and execute commands communicated to said memory from another computer after execution of said main operating program; and where said commands direct the execution of firmware functions stored within said firmware.

* * * * *

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION
CIVIL ACTION NO. 3:21-CV-00506-KDB-DCK

HONEYWELL INTERNATIONAL INC.; HAND HELD PRODUCTS, INC.; AND METROLOGIC INSTRUMENTS, INC.,

Plaintiffs,

v.

OPTO ELECTRONICS CO., LTD.,

Defendant.

ORDER

THIS MATTER is before the Court on Plaintiffs' (collectively "Honeywell") and Defendant OPTO Electronics Co., LTD's ("OPTO"): (1**)** cross motions for Summary Judgment and Partial Summary Judgment on Plaintiff's claims (Doc. Nos. 116, 132); (2) cross motions for Summary Judgment on Defendant's patent misuse counterclaim (Doc. Nos. 161, 168); (3) Motions to Strike and exclude the testimony of one of each side's expert witnesses (Doc. Nos. 137, 173); and (4) discovery objections not resolved by the Court's recent Order (Doc. No. 154). The Court has carefully considered these motions, the parties' briefs and exhibits, and oral argument on the motions from the parties' counsel on April 13, 2023. In the manner and for the reasons discussed below, the Court will in part **GRANT** and in part **DENY** the motions for summary judgment, in part **GRANT** and in part **DENY** the Motions to Strike and affirm the discovery objections (Issues Nos. 6 and 8).

Applying governing Delaware law to the construction and interpretation of the parties' patent licensing agreement ("Agreement"), the Court finds that the disputed Section 1.4 definition of "2D Barcode Products" (on which the obligation to pay royalties depends) and the terms of Honeywell's entitlement to additional payments for pre-Agreement sales under Section 5.1 are not ambiguous. More particularly, the Court finds that Honeywell's reading of Section 1.4 of the Agreement is correct and partial summary judgment will be entered so construing the Agreement. With respect to Section 5.1, however, the Court finds that the Agreement should be construed as argued by OPTO. The additional payments on pre-Agreement sales described in Section 5.1 must be determined by an audit that must be "conducted" within one year of the "Effective Date" of the Agreement. There can be no genuine dispute that the audit performed here occurred, in whole or in part, outside the one-year period. Therefore, OPTO will be granted summary judgment on Plaintiffs' claim under Section 5.1.

Regarding the parties' cross motions for summary judgment on OPTO's patent misuse counterclaims, the Court will deny both motions. The Court finds that no party is entitled to summary judgment in their favor because there is neither the presence of patent misuse *per se* nor the absence of patent misuse as a matter of law on the disputed record before the Court. Therefore, the Court must decide the merits of OPTO's patent misuse counterclaim at trial.

As to the Motions to Strike, the Court finds that Honeywell's proffered expert witness David O. Taylor's proposed testimony is nothing more than legal argument and opinion as to the proper interpretation of the Agreement (which is the province of the Judge, the jury and trial counsel) and thus the motion to strike his testimony will be granted. However, the Court will deny Honeywell's motion to strike OPTO's expert Greg Adams' testimony. While the specific

parameters and weight of his testimony will ultimately be decided at trial, the Court does not find that his testimony should be excluded, particularly where his testimony relates solely to the patent misuse counterclaim which will be decided by the Court rather than the jury.

Finally, on the two remaining discovery issues, even if the issues were not mooted because the Court finds that communications related to the Section 5.1 sales audit Honeywell relies on in seeking this discovery are no longer relevant, the Court will not permit the discovery, which appears to be nothing more than an attempt to discover OPTO's counsel's thoughts with respect to the merits of Honeywell's claims. Accordingly, OPTO's objections will be allowed and the remaining discovery requests will be denied.

I. LEGAL STANDARD

Summary judgment is appropriate "if the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law." *United States v. 8.929 Acres of Land in Arlington Cnty., Virginia*, 36 F.4th 240, 252 (4th Cir. 2022) (quoting Fed. R. Civ. P. 56(a)); *see United States, f/u/b Modern Mosaic, LTD v. Turner Construction Co*., *et al*., 946 F.3d 201, 206 (4th Cir. 2019). A factual dispute is considered genuine "if the evidence is such that a reasonable jury could return a verdict for the nonmoving party." *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 248 (1986); *8.929 Acres of Land*, 36 F.4th at 252. "A fact is material if it might affect the outcome of the suit under the governing law." *Id.*, (quoting *Libertarian Party of Va. v. Judd*, 718 F.3d 308, 313 (4th Cir. 2013)).

The party seeking summary judgment bears the initial burden of demonstrating the absence of a genuine issue of material fact through citations to the pleadings, depositions, answers to interrogatories, admissions, or affidavits in the record. *See Celotex Corp. v. Catrett*, 477 U.S. 317,

323 (1986) (when the nonmoving party "has failed to make a sufficient showing on an essential element of [his] claim with respect to which [he] has the burden of proof," summary judgment is warranted); *United States ex rel. Gugenheim v. Meridian Senior Living, LLC*, 36 F.4th 173, 178 (4th Cir. 2022). If the movant satisfies his initial burden to demonstrate "an absence of evidence to support the nonmoving party's case," the burden shifts to the nonmovant to "present specific facts showing that there is a genuine issue for trial." *8.929 Acres of Land*, 36 F.4th at 252, quoting *Humphreys & Partners Architects, L.P. v. Lessard Design, Inc.*, 790 F.3d 532, 540 (4th Cir. 2015). "The mere existence of *some* alleged factual dispute between the parties will not defeat an otherwise properly supported motion for summary judgment. *Hixson v. Moran*, 1 F.4th 297, 302 (4th Cir. 2021). Rather, the nonmoving party must establish that a material fact is genuinely disputed by, *inter alia*, "citing to particular parts of the materials of record" and cannot rely only on "conclusory allegations, mere speculation, the building of one inference upon another, or the mere existence of a scintilla of evidence." Fed. R. Civ. P. 56(c)(1)(A); *8.929 Acres of Land*, 36 F.4th at 252, quoting *Dash v. Mayweather*, 731 F.3d 303, 311 (4th Cir. 2013).

Still, summary judgment is not intended to be a substitute for a trial of the facts. *Anderson*, 477 U.S. at 249. In determining if summary judgment is appropriate, "courts must view the evidence in the light most favorable to the nonmoving party and refrain from weigh[ing] the evidence or mak[ing] credibility determinations." *Variety Stores, Inc. v. Wal-Mart Stores, Inc.*, 888 F.3d 651, 659 (4th Cir. 2018) (internal quotation marks omitted) (quoting *Lee v. Town of Seaboard*, 863 F.3d 323, 327 (4th Cir. 2017). "Summary judgment cannot be granted merely because the court believes that the movant will prevail if the action is tried on the merits." *Jacobs v. N.C. Admin. Office of the Courts*, 780 F.3d 562, 568-69 (4th Cir. 2015) (quoting 10A Charles

Alan Wright & Arthur R. Miller et al., Federal Practice & Procedure § 2728 (3d ed.1998)). In the end, the relevant inquiry on summary judgment is "whether the evidence presents a sufficient disagreement to require submission to a jury or whether it is so one-sided that one party must prevail as a matter of law." *Anderson*, 477 U.S. at 251–52. "When faced with cross-motions for summary judgment, the court must review each motion separately on its own merits to determine whether either of the parties deserves judgment as a matter of law." *Rossignol v. Voorhaar*, 316 F.3d 516, 523 (4th Cir. 2003) (internal quotation and citation omitted).

II. FACTS AND PROCEDURAL HISTORY

Honeywell and OPTO, a Japanese company, are competitors in the market for bar code scanning equipment and technology. In 2020, the Parties purported to settle extensive patent litigation at the U.S. International Trade Commission and in the United States District Court for the District of Delaware through a patent licensing agreement. The parties agree that the Agreement is governed by and to be construed under the laws of the State of Delaware (as well as applicable federal law). In brief summary, Honeywell claims that OPTO[1] has breached the Agreement by misstating the amount of OPTO's pre-Agreement sales of certain alleged "2D" barcode scanning products and failing to pay ongoing royalties on those products. OPTO has filed counterclaims for unfair trade practices and patent misuse, alleging that Honeywell is using the Agreement to unlawfully seek royalties on features of products for which they do not have patent protection. Each side denies the other's claims.

[1] As reflected in the Agreement provisions quoted below, the Agreement also includes OPTICON, the name of an OPTO subsidiary, as a primary transaction party. The references to OPTO in this Order are intended to be inclusive of OPTICON and there is no contention that the proper parties are not before the Court.

In their respective motions for summary judgment on Honeywell's affirmative claims, (Doc. Nos. 116, 132), the parties urge the Court with equal ardor to find that the core dispute in the case – identifying the products on which royalties must be paid under the Agreement – must be answered in their favor based on the "unambiguous" language of the Agreement. Specifically, the parties ask the Court to construe the meaning of Section 1.4 of the Agreement, which defines "2D Barcode Products" as follows:

> The term '2D Barcode Products' shall mean any device or article of manufacture that is operable to decode at least one or more two-dimensional barcode symbologies into human-readable text. Two-dimensional ('2D') barcode symbologies include, but are not limited to, any two-dimensional barcode symbology defined by one or more standards settings organizations such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), and the Association for Automatic Identification and Mobility (AIM). For the avoidance of doubt, the term '2D Barcode Product' shall include Engines and other products that include a 2D image sensor and are capable of outputting a 2D image that may be used to decode a 2D barcode symbology into human-readable text.

Doc. No. 51-2, at § 1.4.

Also, the parties have differing interpretations of Section 5.1 of the Agreement, in which OPTO provided various "Representations and Warranties," including the following representation related to the amount of OPTO's pre-agreement sales of "2D Barcode Products" and a process for Honeywell to "audit" that representation and obtain additional payments, if it chose to do so:

> OPTICON further represents and warrants that OPTICON Gross Revenue of 2D Barcode Products in (i) the United States for the past six (6) years and (ii) Europe and Japan for the past five (5) years, totals not more than one hundred and two million U.S. Dollars ($102,000,000). OPTICON will provide sates reports to HONEYWELL'S outside counsel pursuant to the governing ITC Investigation Protective Order such that the above worldwide Opticon Gross Revenue can be verified. HONEYWELL INTERNATIONAL, through an independent certified public accounting firm, shall have the right, at HONEYWELL INTERNATIONAL's expense, to audit OPTICON's records for the purpose of

> determining the accuracy of OPTICON's worldwide sales; provided that HONEYWELL INTERNATIONAL provides OPTICON with reasonable prior notice, and such audit is conducted during OPTICON's normal business hours. Such audit may be conducted no more than one (1) time within one (1) calendar year of the Effective Date. Should an audit show OPTICON Gross Revenue of 2D Barcode Products in (i) the United States for the past six (6) years and (ii) Europe and Japan for the past five (5) years in excess of one hundred and seven million U.S. Dollars ($107,000,000), OPTICON shall (i) pay to HONEYWELL INTER.NATIONAL 8.8°/o of the difference between the audited OPTICON Gross Revenue of 2D Barcode Products and $102,000,000 and (ii) reimburse HONEYWELL INTERNATIONAL for the reasonable cost of such audit. OPTICON shall have the right to require that the independent certified public accounting firm HONEYWELL INTERNATIONAL retains to perform the audit enter into a confidentiality agreement preventing the disclosure of confidential cost and pricing data and other competition sensitive information to HONEYWELL INTERNATIONAL and Third Parties.

III. DISCUSSION

A. Motions for Summary Judgment

1. Cross Motions on Plaintiff's Claims

The governing principles of contract interpretation under Delaware law are well established and not disputed among the parties. *See Weinberg v. Waystar, Inc.*, No. 274, 2022, 2023 WL 2534004, at *3–4 (Del. Mar. 16, 2023). Recently, the Supreme Court of Delaware summarized how contracts are construed in Delaware as follows:

> In construing a contract, our goal is to give effect to the intent of the parties. "Delaware adheres to the 'objective' theory of contracts, *i.e.* a contract's construction should be that which would be understood by an objective, reasonable third party." We will read the contract as a whole and "enforce the plain meaning of clear and unambiguous language." In doing so, we endeavor "to give each provision and term effect" and not render any terms "meaningless or illusory."
>
> Moreover, "[i]n giving sensible life to a real-world contract, courts must read the specific provisions of the contract in light of the entire contract." Where language is unambiguous, we "will give effect to the plain meaning of the contract's terms and provisions." "Language is ambiguous if it is susceptible to more than one reasonable interpretation." "An interpretation is unreasonable if it 'produces an absurd result' or a result 'that no reasonable person would have accepted when

> entering the contract.'" "The parties' steadfast disagreement over interpretation will not, alone, render the contract ambiguous." "The determination of ambiguity lies within the sole province of the court."

Id. (footnotes omitted). Courts may not consider extrinsic evidence unless the text of a contract is ambiguous. *Samuel J. Heyman 1981 Continuing Tr. for Lazarus S. Heyman v. Ashland LLC*, 284 A.3d 714, 721 (Del. 2022).

However, confronted with an ambiguity, courts must consider the relevant extrinsic evidence. In doing so, the Court's ultimate goal does not change; it still must ascertain the parties' intentions at the time they entered into the contract. *Fortis Advisors, LLC v. Dematic Corp.*, No. N18C-12-104 AML CCLD, 2022 WL 18359410, at *19 (Del. Super. Ct. Dec. 29, 2022). Rather, a court construing an ambiguous contract must discern that intent from more than the language contained in the contract's four corners. *Id*. Again, according to the Delaware Supreme Court, "[t]he standard for interpreting ambiguous contracts is well settled: If the contract is ambiguous, a court will apply the parol evidence rule and consider all admissible evidence relating to the objective circumstances surrounding the creation of the contract. Such extrinsic evidence may include overt statements and acts of the parties, the business context, prior dealings between the parties, [and] business custom and usage in the industry." *Salamone v. Gorman*, 106 A.3d 354, 374–75 (Del. 2014). Nevertheless, "the private, subjective feelings of negotiators are irrelevant and unhelpful to the Court's consideration of a contract's meaning, because the meaning of a properly formed contract must be shared or common." *XRI Inv. Holdings LLC v. Holifield*, 283 A.3d 581, 612 (Del. Ch.), *judgment entered*, (Del. Ch. 2022), quoting *United Rentals, Inc. v. RAM Hldgs., Inc.*, 937 A.2d 810, 835 (Del. Ch. 2007).

Applying these principles to the question of the interpretation of the Agreement's definition of "2D Barcode Products" in Section 1.4, the Court finds that the language of that section is unambiguous. *See* Doc. No. 51-2, at § 1.4. Honeywell asks the Court to hold that Section 1.4 should be read to define "2D Barcode Products" primarily as "any device or article of manufacture that is operable to decode at least one or more two-dimensional barcode symbologies into human-readable text," tracking the first sentence of Section 1.4. Honeywell further argues that the second sentence of the definition – "Two-dimensional ('2D') barcode symbologies include, but are not limited to, any two-dimensional barcode symbology defined by one or more standards settings organizations such as the International Organization for Standardization …" – should be construed as providing a partial definition of what qualifies under the Agreement as a "two dimensional barcode symbology." And, finally, Honeywell contends that the third sentence, "For the avoidance of doubt, the term '2D Barcode Product' shall include Engines and other products that include a 2D image sensor and are capable of outputting a 2D image that may be used to decode a 2D barcode symbology into human-readable text," reflects a clarification that royalty-bearing "2D Barcode Products" also include a "niche" product – "Engine" hardware that does not itself decode 2D barcodes but may be used with additional software to do so.[2]

In contrast, OPTO asks the Court to read the third sentence of Section 1.4 as the primary, limiting sentence of the definition. OPTO contends that the first sentence is "ambiguous" because

[2] Honeywell calls these products "uncoded" Engines and contends that this sentence was added to prevent OPTO from selling such products without paying a royalty. At oral argument, OPTO acknowledged that at the time of the Agreement it did not sell "uncoded" Engine products, but does currently (although OPTO also offered an entirely different interpretation of the third sentence of Section 1.4 as discussed *infra*).

what is encompassed within "two dimensional barcode symbologies" is unclear[3] and therefore the limitations of the third sentence – primarily the requirement that the product contain a "2D image sensor"[4] – are necessary to make the definition workable. According to OPTO's view, the first sentence then plays only a supporting role in limiting the scope of the third sentence, which would otherwise sweep too broadly and include items such as a digital camera which can take a picture of a barcode.

The Court agrees with Honeywell. First, it is unreasonable to assume that the parties "buried the lead" and put the primary limitations of the definition in a ***third*** sentence that follows two otherwise clear sentences (which would then become effectively unnecessary). This is particularly true because OPTO admitted as noted above that at the time of the Agreement it did not sell any product that came within the full scope of the third sentence. Also, the fact that Section 1.4 did not define what is considered to be a two-dimensional barcode symbology (beyond the second sentence) does not require that the third sentence be read as a strict, controlling limitation on the first sentence. Rather, to the extent that the parties dispute whether a particular barcode is or is not a two-dimensional symbology then it will be up to a jury to decide that question. Finally, the Agreement defines "including" to mean "including without limitation." *See* Doc. No. 51-2, at § 9.4. While the wording "shall include" is slightly different so that the definition of "including"

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[3] Presumably, this ambiguity is only beyond what is included within the second sentence, although OPTO also contends that sentence is ambiguous because the definitions of the various organizations listed are only referenced generally.

[4] Perhaps not coincidentally, none of the OPTO products in dispute have a 2D image sensor so they would all fall outside of the scope of the definition of royalty bearing products if Section 1.4 was read to include that requirement.

is not dispositive, the parties' clearly expressed intent to broaden the meaning of "including" lends further support to Honeywell's reading of the third sentence of Section 1.4.

In sum, the Court finds that Honeywell's proposed construction of Section 1.4 is the only reasonable way to objectively[5] read the plain language of that section and summary judgment will be granted adopting that construction.

With respect to the second disputed provision of the Agreement, the Court finds that Section 5.1 of the Agreement is also unambiguous (as relevant to this dispute). However, that plain language cuts in favor of OPTO, requiring entry of summary judgment in its favor on Honeywell's claim for breach of contract under Section 5.1. In the Complaint, Honeywell asserts that OPTO breached its representations as to the amount of its pre-agreement sales of "2D Barcode Products," thereby obligating OPTO to pay the "monetary damages specified in the Agreement." Doc. No. 1 at ¶ ¶ 24, 34. Specifically, Honeywell alleged that

- the obligation to pay a percentage of the amount of revenue exceeding the amount represented depended on the findings of a sales audit, *id*. at ¶ 21;
- Honeywell invoked its audit rights under the Agreement, *id*. at ¶ 22;
- the audit showed that OPTO's representation as to the amount of its sales was understated, *id*. at ¶ 23;

[5] OPTO asks the Court to construe Section 1.4 to exclude the disputed products from the definition of "2D Barcode Products" based on extrinsic evidence of what patents were to be tried in the ITC action and "claim charts" prepared in that litigation in which Honeywell lists the disputed "laser scanning" products as 1D products. While that evidence may well be relevant to the jury question of what barcodes are two-dimensional symbologies under Section 1.4, it may not be used to avoid the clear language of the Agreement.

- "*therefore* [OPTO] breached its representations and warranties and materially breached the Agreement…," *Id.* at ¶ 24. (emphasis added); and
- "… Honeywell is entitled to *certain monetary damages specified in the Agreement*." *Id.* at ¶ 24. (emphasis added).

OPTO argues that Honeywell cannot recover the additional payments "specified in Section 5.1" because Honeywell did not conduct the audit on which the payments must be based within the time required by the Agreement. The Court agrees. As stated above, if Honeywell does not want to accept OPTO's represented amount of sales, Section 5.1 gives Honeywell the right to audit OPTO's records to determine the accuracy of OPTO's representations, but specifically limits how many audits may be conducted and the time during which the audit may take place: "Such audit may be conducted no more than one (1) time within one (1) calendar year of the Effective Date." Doc. No. 118-2 at §5.1. And, it is similarly clear that the agreement to make the additional payment sought by Honeywell depends on an audit being conducted, with the words "[s]hould an audit show" … [a certain amount of sales]," directly preceding the terms of that payment obligation. *Id.*; *see also* Doc. No. 1 at ¶ 21 ("The Agreement provides that if the audit shows actual revenues exceeded the represented amount … then Opticon must pay Honeywell …")

The parties do not dispute that the audit on which Honeywell bases its claim was "conducted," (i.e. "occurred") at least in part, outside of one year of the Effective Date. Nevertheless, Honeywell suggests that the audit should be considered timely (that is, the audit was "conducted" within one year of the Effective Date) because Honeywell "noticed" the audit in December 2020, approximately one month before the end of the period, and selected an auditor by January 2021, before the year ran out. Even assuming, without deciding, that such events reflect

"conducting" the audit, it is not disputed that the audit was not started in time to reasonably be completed within the one-year period and was still being actively "conducted" months after the one-year anniversary of the Effective Date.

Moreover, in the Agreement, it is clear that "conducted" means, with respect to time limitations, "to pursue within the allotted time." "Conducted" is used twice in Section 5.1, in consecutive sentences.[6] Doc. No. 118-2 at §5.1. In the first, the parties agreed that the audit must be "conducted during OPTICON'S normal business hours." *Id.* Plainly, this means audit work must take place *during* normal business hours, not simply that Honeywell was only obligated to begin work within those hours but could conclude at any time later. Similarly, when the parties agreed that "[s]uch audit may be conducted no more than one (1) time within (1) calendar year of the Effective Date" they meant that the audit work was required to take place *during* the first calendar year following the Effective Date.

Also, if the Court accepts Honeywell's position that the Agreement is satisfied because only one auditor conducted only one audit between the Effective Date of January 22, 2020, and one year later, on January 22, 2021 (even if the same audit was also "conducted" later), it would lead to the absurd result that the Agreement limits only the number of audits conducted during the first year and sets no time limit at all on the completion of an audit "initiated" within that year. In other words, under Honeywell's proposed interpretation, multiple audits would be permissible outside the one year period and all audits, whenever started, could go on for years without any limitation. This is simply not a reasonable reading of Section 5.1. *See Weinberg*, 2023 WL

[6] It is normally presumed that a given word or phrase is used to mean the same thing throughout an agreement or statute. *See Brown v. Gardner*, 513 U.S. 115, 119, 115 S.Ct. 552, 130 L.Ed.2d 462 (1994).

2534004 at *3–4. (“An interpretation is unreasonable if it ‘produces an absurd result’ or a result ‘that no reasonable person would have accepted when entering the contract.’”). Rather, the parties plainly intended to allow only one audit and set, in effect, a period of limitations[7] during which the audit could be conducted.

Finally, Honeywell argues that the Court should permit its Section 5.1 claim to proceed because the audit was “optional,” and Honeywell is allegedly entitled to pursue a claim for OPTO’s allegedly inaccurate representations for “damages” independent of any audit. Indeed, for the first time at oral argument, Honeywell informed the Court that it did not intend to seek to recover damages for its Section 5.1 claim based on the specific audit remedy in Section 5.1 (notwithstanding its repeated and clear statements to the contrary in its Complaint) but instead planned to seek an amount of damages based on an 8.8% payment on pre-Agreement sales in excess of $102 million, which it calculates based on dividing $9 million (the amount of the two first year payments required by Section 4.2 of the Agreement) by the amount of represented sales, $102 million. Counsel then acknowledged that this 8.8% payment was the exact same amount as the 8.8% audit remedy in Section 5.1.

Of course, this is hardly a coincidence. While the Agreement does not specifically connect the $9 million payments to past sales, the audit remedy percentage is no doubt derived from this same calculation. (In contrast, the post-Agreement royalty percentage is 7%). Such an obvious end run around the audit requirement and limitations will not be permitted. If Honeywell wants to

[7] The Court notes that the one-year period is consistent with the due date of the “second payment” under Section 4.2 (which – although not directly connected in the Agreement – appears to reflect the payments that the parties intended to compensate Honeywell for OPTO’s pre-Agreement sales).

enforce the parties' agreement to pay 8.8% of underreported sales (either as specified in Section 5.1 or by simply "doing the math" to replicate the calculation from which the percentage in Section 5.1 was derived) then it must comply with the parties' agreement on how additional payments will be made (i.e. after a timely audit), which was not done.

Finally, even if Honeywell now sought to pursue a contractual claim for "breach of representation and warranty" against OPTO completely untethered to the Agreement's audit remedy (or a facsimile of it as proposed during oral argument),[8] it would be inappropriate for the Court to allow it. First, properly construed, the Agreement precludes a claim of breach related to the reporting of sales in Section 5.1 outside of the agreed detailed process for pursuing additional payments. In Section 5.1, the parties agreed that before OPTO had an obligation to make any additional payments on unreported sales, the audit must show sales in excess of $107 million, $5 million more than the $102 million in sales represented. In other words, if OPTO's sales representation was within $5 million of the actual amount found by the audit then OPTO owed no additional payments.[9]

Thus, the parties agreed to a specific formula for determining additional payments that would differ materially from a standard damages remedy in which a party may recover all its damages, not only when a proven false representation is off by more than $5 million. In other words, if the Court were to permit Honeywell to pursue a "breach of representation and warranty

[8] For example, Honeywell speculates that it could have come to believe that OPTO's representation as to the amount of its sales was inaccurate without an audit and immediately filed a claim for breach.

[9] If the amount found by the audit exceeded $107 million then the additional payments were required on the difference between the actual amount and $102 million, the original amount.

claim" totally removed from the audit remedy (or any related calculation) then Honeywell would be able to assert a claim for damages[10] that effectively negates the $5 million "buffer" that OPTO bargained for and received in the Agreement. Under Delaware law, the Court is not permitted to construe the Agreement as permitting claims that write out provisions of the Agreement. *See Weinberg v. Waystar, Inc.*, No. 274, 2022, 2023 WL 2534004, at *3–4 (Del. Mar. 16, 2023) ("In construing a contract, … [we] endeavor 'to give each provision and term effect' and not render any terms 'meaningless or illusory.'"). Therefore, properly construed, while the audit was "optional" in the sense that it was not required unless Honeywell chose to request it, the Agreement required that Honeywell conduct a timely audit to recover additional payments based on any misrepresentation of prior sales by OPTO.

Also, even if Honeywell is correct that the Agreement does not limit its ability to make a claim of breach unrelated to the audit remedy, Honeywell chose to pursue the audit remedy and asserted only a claim based on that remedy. As discussed in detail above, Honeywell acted in accordance with the Agreement in requesting an audit (albeit belatedly) then tied its claim to the audit that was conducted and sought to recover "certain monetary damages specified in the Agreement." *See* Doc. No. 1 at ¶¶ 21-24. Again, to recover those "specified" damages, a timely audit was required, but simply did not occur here. Therefore, applying the plain language of Section 5.1, Honeywell's asserted claim for an additional payment as specified under Section 5.1 cannot proceed.

[10] For purposes of this analysis, it does not matter that Honeywell claims tens of millions of dollars in underreported sales. Rather, the issue is whether the Court can interpret the Agreement to allow an independent claim that effectively (and impermissibly under Delaware law) reads out of the Agreement a bargained for limitation on OPTO's liability, even if that limitation might not apply in a particular case.

Moreover, it is too late in the litigation for Honeywell to amend the Complaint to assert a different claim, thereby requiring discovery to be reopened, etc. *See Faulconer v. Centra Health, Inc.*, 808 F. App'x 148 (4th Cir. 2020); *Cloaninger v. McDevitt*, 555 F.3d 324, 336 (4th Cir. 2009); *Wahi v. Charleston Area Med. Ctr., Inc.*, 562 F.3d 599, 617 (4th Cir. 2009); *Duke Energy Fla., Inc. v. Westinghouse Elec. Co. LLC*, No. 3:14-cv-00141-MOC-DSC, 2016 U.S. Dist. LEXIS 134453, at *12 (W.D.N.C. Sep. 29, 2016). The parties have focused their (considerable) efforts on the claims asserted and it would be wrong to allow a material change now, after summary judgment.

Therefore, applying the plain language of the Agreement, the Court will grant summary judgment in favor of OPTO on Honeywell's claim under Section 5.1.

2. Cross Motions on Defendant's Patent Misuse Counterclaim

The parties have each moved for summary judgment on OPTO's counterclaim alleging that the Agreement reflects "patent misuse." Doc. Nos. 161, 168. Specifically, OPTO contends that Honeywell's demand that OPTO pay patent royalties on OPTO's disputed laser scanning products is *per se* patent misuse for two reasons.[11] First, it argues that the Agreement requires OPTO to pay ongoing royalties on Honeywell's '783 Patent, which has now expired. Second, it claims that Honeywell is unlawfully attempting to extract royalties for functionality (here, the ability to decode stacked barcode symbologies) that is not covered by an active Honeywell patent. In turn, Honeywell seeks summary judgment on the patent misuse counterclaim on the grounds that it is

[11] In its motion, OPTO seeks an order dismissing Honeywell's Complaint in this case and declaring the royalty collection provisions of the Agreement unenforceable. *See* Doc. No. 169 at 4. However, in oral argument, OPTO clarified that it was not seeking to avoid the payment of royalties on its "2D Barcode Products" that are not in dispute, only the approximately 50 "laser scanning" products that encompass the parties' disagreement.

entitled to royalties on OPTO's products under the licensed "package" of patents, which includes numerous unexpired patents, and "scores" of its unexpired patents cover OPTO's royalty bearing products. For the reasons discussed below, the Court finds that neither party is entitled to summary judgment on their motion.

"The grant to the inventor of the special privilege of a patent monopoly carries out a public policy adopted by the Constitution and laws of the United States, 'to promote the Progress of Science and useful Arts, by securing for limited Times to ... Inventors the exclusive Right ...' to their 'new and useful' inventions." *Morton Salt Co. v. G.S. Suppiger Co.*, 314 U.S. 488, 492 (1944) (quoting United States Constitution, Art. I, § 8, Cl. 8, 35 U.S.C.A. § 31). "But the public policy which includes inventions within the granted monopoly excludes from it all that is not embraced in the invention. It equally forbids the use of the patent to secure an exclusive right or limited monopoly not granted by the Patent Office and which it is contrary to public policy to grant." *Morton Salt Co.*, 314 U.S. 488, 492 (1942).

Accordingly, to ensure that the patentee does not prosper from an impermissible broadening of the "physical or temporal scope" of the patent grant, the courts long have recognized the doctrine of patent misuse as an affirmative defense to a suit for patent infringement. *Windsurfing Int'l, Inc. v. AMF, Inc.*, 782 F.2d 995, 1001 (Fed. Cir. 1986) (quoting *Blonder–Tongue Labs. Inc. v. University of Ill. Found.*, 402 U.S. 313, 343 (1971)); *Princo Corp. v. Int'l Trade Comm'n*, 616 F.3d 1318, 1321 (Fed. Cir. 2010). The doctrine is an extension of the equitable doctrine of unclean hands, *Qualcomm Inc. v. Broadcom Corp.*, 548 F.3d 1004, 1025 (Fed. Cir. 2008), and, as an equitable doctrine, the ultimate question of patent misuse must be decided by the

Court. *Va. Panel Corp. v. MAC Panel Oc.*, 133 F.3d 860, 868 (Fed. Cir. 1997) (holding that patent misuse is "an equitable issue normally reserved for the court").

In the licensing context, the doctrine limits a patentee's right to impose conditions on a licensee that exceed the scope of the patent right. *Princo*, 616 F.3d at 1321. Thus, the "basic rule of patent misuse [is] that the patentee may exploit his patent but may not use it to acquire a monopoly not embraced in the patent." *Id*. at 1327. When the patentee has used restrictive conditions on licenses or sales to broaden the scope of the patent grant, courts have held that an accused infringer may invoke the doctrine of patent misuse to defeat the patentee's claim. *Princo*, 616 F.3d at 1327–28; *Monsanto Co. v. McFarling*, 363 F.3d 1336, 1341 (Fed. Cir. 2004). What patent misuse is about, in short, is "patent leverage," i.e., the use of the patent power to impose overbroad conditions on the use of the patent in suit that are "not within the reach of the monopoly granted by the Government." *Zenith Radio Corp. v. Hazeltine Research, Inc.* 395 U.S. 100, 136–38 (1969).

Patent misuse "requires that the alleged infringer show that the patentee has impermissibly broadened the physical or temporal scope of the patent grant with anticompetitive effect." *Virginia Panel*, 133 F.3d at 868–71 (internal citation omitted). "Courts have identified certain specific practices as constituting *per se* patent misuse, including so-called 'tying' arrangements in which a patentee conditions a license under the patent on the purchase of a separable, staple good" and "arrangements in which a patentee effectively extends the term of its patent by requiring post-expiration royalties." *Va. Panel Corp.*, 133 F.3d at 869 (citations omitted). However, unless a licensing arrangement has been held to be *per se* anticompetitive by the Supreme Court, a factual

determination must reveal that the overall effect of the license tends to restrain competition unlawfully in an appropriately defined relevant market.[12] *See Princo*, 616 F.3d 1334.

OPTO's first allegation of *per se* patent misuse is that the '783 Patent, which OPTO contends is the only Honeywell patent potentially covering the decoding of stacked barcodes, has expired so any ongoing royalty payments for those products are unlawfully extending the life of that patent. *See Brulotte v. Thys Co.*, 379 U.S. 29, 32-33 (1964). In response, Honeywell argues that under *Kimble v. Marvel Entm't*, 576 U.S. 446, 454 (2015), "royalties may run until the latest-running patent covered in the parties' agreement expires"; therefore, because the licensed Honeywell portfolio spans thousands of patents, the majority of which remain unexpired, the Agreement is enforceable. While Honeywell exaggerates the holding of *Kimble*, the Court agrees that OPTO's concession that there are a number of unexpired Honeywell patents that cover the disputed products means that OPTO's claim of *per se* patent misuse based on the expiration of the '783 Patent cannot succeed.

In *Brulotte*, the Supreme Court considered whether a license covering a farm machine was enforceable even though all of the patents incorporated into the machine[13] had expired. *See Brulotte*, 379 U.S. at 29-30. The Court held that the post-patent royalty provision was

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[12] While not directly controlling here, in 1988, Congress amended the Patent Act to limit the scope of "patent misuse" with respect to certain licensing practices by including the concept of "market power." 35 U.S.C. § 271(d) ("No patent owner … shall be … deemed guilty of misuse … [by] "(5) condition[ing] the license of any rights to the patent or the sale of the patented product on the acquisition of a license to rights in another patent or purchase of a separate product, unless, in view of the circumstances, the patent owner has market power in the relevant market for the patent or patented product on which the license or sale is conditioned.").

[13] Significantly, of the twelve patents licensed to the *Brulotte* petitioners only seven were incorporated into the machine. The decision noted that all of those seven patents had expired prior to the end of the license, but was silent as to whether any of the other five were still active. *See Brulotte*, 379 U.S. at 30.

"unlawful *per se*," *id.*, at 30, 32, because it continued "the patent monopoly beyond the [patent] period," *id.*, at 33, and, in so doing, conflicted with patent law's policy of establishing a "post-expiration ... public domain." *Id*. at 30, 34 ("We conclude that the judgment below must be reversed insofar as it allows royalties to be collected which accrued after the last of the patents incorporated into the machines had expired."); *see Kimble*, 576 U.S. at 446. Fifty-one years later, despite *Brulotte* having received substantial criticism from legal commentators and economists, the Supreme Court upheld the decision in *Kimble*, strictly on the grounds of *stare decisis*. *Id*. at 455-459. Thus, the *Brulotte* rule – that a patent license may run until the expiration of the last of the patents covering the product or practice at issue – remains binding on this Court. *See Scheiber v. Dolby Lab'ys, Inc.*, 293 F.3d 1014, 1018 (7th Cir. 2002) (Posner, J) (declaring, with respect to *Brulotte*, "we have no authority to overrule a Supreme Court decision no matter how dubious its reasoning strikes us, or even how out of touch with the Supreme Court's current thinking the decision seems").

Neither party here properly applies *Brulotte*. OPTO asks the Court to find that *Brulotte* does not apply to "package licensing" agreements that contain expired patents, citing *A.C. Aukerman Co. v. R.L. Chaides Construction Co*., No. CIV. 88–20704 SW, 1993 WL 379548, at *6 (N.D.Cal. Sept.13, 1993). The Court finds *Aukerman* wholly unpersuasive. Beyond the fact that it is a thirty year old unpublished decision outside this Circuit, the entirety of the "analysis" of the *Brulotte* licensing issue in *Aukerman* runs a single conclusory sentence, citing for authority only a 1968 Tenth Circuit decision that does not even mention *Brulotte*. Indeed, in *Scheiber* the Court specifically noted that *Aukerman* "misreads *Brulotte*." *Scheiber*, 293 F.3d at 1021.

For its part, Honeywell misreads *Kimble* as expanding *Brulotte* beyond its facts to allow a patent owner to enforce a license of multiple patents so long as any of those patents remained active, regardless of whether any of the unexpired patents covered the product or practice being licensed. *Kimble*[14] plainly intended no change in *Brulotte*; indeed, that was the point of its *stare decisis* analysis. Further, accepting Honeywell's enlargement of *Brulotte* would allow a patent owner to too easily evade its holding by including within a "package license" a recent patent, no matter how irrelevant. The Court thus declines to change the *Brulotte* rule, either as proposed by OPTO or Honeywell.

Rather, the Court will enforce *Brulotte* according to its terms. Here, OPTO admitted at oral argument (albeit reluctantly) that the products in dispute are covered by non-expired Honeywell patents. Therefore, regardless of whether the use of those non-expired patents is the basis for the payment of royalties in the Agreement, under *Brulotte*, OPTO cannot succeed on a claim that the Agreement constitutes patent misuse *per se* based on the expiration of one or more of the patents initially licensed. The life of the license in the Agreement has not and will not exceed the life of all the patents covering the products in dispute so no patent misuse (in this regard) has been committed.

OPTO's second asserted ground for its counterclaim is also not patent misuse *per se*; however, the Court finds that the counterclaim should survive Honeywell's cross motion. Whether or not Honeywell has unlawfully conditioned the payment of royalties on the ability of OPTO's products to decode stacked barcode symbologies (a practice over which it has no patent rights)

[14] Also, *Kimble* involved only a single patent so any comment related to multiple patent licenses would be purely *dicta*.

cannot be decided at summary judgment, where there remains (at least) a dispute over Honeywell's economic power over such technology.

Most simply put, the parties portray the nature of the Agreement's royalty requirements differently, with their desired outcomes flowing from their respective characterizations. Consistent with Honeywell's representations, OPTO describes the royalty provisions (as they relate to the disputed products) as turning solely on if the products can decode stacked barcode symbologies. In OPTO's telling, the Agreement in practical effect provides that OPTO can license Honeywell's patents only if OPTO pays royalties for selling products that decode stacked bar code symbologies, which OPTO says is patent misuse because Honeywell has no active patents that cover that decoding technology. Honeywell in turn emphasizes that all the disputed products are covered by numerous Honeywell patents – which gives Honeywell the right to not allow the products to be sold or to obtain a royalty for the use of the patents. So, according to Honeywell, it cannot be patent misuse for the parties to agree that OPTO only has to pay royalties for a subset of those products, regardless of how the Agreement determines which products are royalty bearing.

Both parties are correct, but only partially. Again, the "basic rule of patent misuse [is] that the patentee may exploit his patent but may not use it to acquire a monopoly not embraced in the patent." *Princo Corp.*, 616 F.3d at 1327. Thus, if a patent owner uses its patent and economic power to exact royalties for inventions or goods outside the scope of the patent, it commits patent misuse but does not do so "[i]f convenience of the parties rather than patent power dictates a … royalty provision …" *Zenith*, 395 U.S. at 138; *Bayer AG v. Housey Pharms., Inc.*, 228 F. Supp. 2d 467, 470 (D. Del. 2002). These principles apply to separable features of products like the ability to decode stacked barcode symbologies – which the parties agree can be turned on and off – as

well as "whole" products. Whether the Agreement was the product of unfair patent leverage exerted by the patentee rather than mutual convenience of the parties is a question of fact. *See Sunrise Med. HHG, Inc. v. AirSep Corp.*, 95 F. Supp. 2d 348, 458 (W.D. Pa. 2000). Moreover, the extent of Honeywell's economic power over the "tied" technology – which OPTO must prove to establish patent misuse in these circumstances – is admittedly disputed.

In sum, the merits of OPTO's counterclaim for patent misuse cannot and should not be determined on cross-motions for summary judgment. Instead, the answers must be found at trial, where there will be a full opportunity to weigh the evidence and assess the credibility of the witnesses. *See Reetz v. Lowe's Companies, Inc.*, No. 518CV00075KDBDCK, 2021 WL 535160, at *1–2 (W.D.N.C. Feb. 12, 2021). Therefore, the Court finds that none of the parties have proven an entitlement to summary judgment on OPTO's counterclaim alleging patent misuse, and the Court will deny the parties' cross-motions for summary judgment on that claim.

B. Motions to Strike Expert Testimony

1. David Taylor

OPTO has moved to exclude the testimony of David O. Taylor, one of Honeywell's proffered expert witnesses. Doc. No. 137. Mr. Taylor is a Professor of Law at the SMU Dedman School of Law who teaches and researches in the area, among others, of patent law, including patent law transactions. Honeywell represents that it intends to offer Professor Taylor's testimony "as an expert in intellectual property transactions" for two purposes: (1) affirmative "factual testimony" in support of Honeywell's breach of contract claim and (2) rebuttal testimony in opposition to OPTO's patent misuse counterclaim and affirmative defense. *See* Doc. No. 155 at 1. Mr. Taylor's expert reports have been provided to the Court at Doc. Nos. 138-1 and 138-2. Broadly

stated, OPTO asks the Court to exclude Professor Taylor's testimony because 1) his reports reflect his intention to testify as to his view of the law and OPTO's legal liability under the Agreement and 2) as to his rebuttal report related to OPTO's counterclaims, that it is procedurally improper.[15]

The Court need not and will not belabor its analysis of Mr. Taylor's proposed testimony,[16] as it is clearly outside the bounds of permissible "legal" testimony, notwithstanding the "complexity" of the Agreement at issue. It is the responsibility of the Court to advise the jury on the governing law.[17] *See United States v. Savage*, 885 F.3d 212, 222–23 (4th Cir. 2018) ("[T]aken as a whole, the instruction [must] fairly state[ ] the controlling law."); *United States v. Miltier*, 882 F.3d 81, 89 (4th Cir. 2018) (instructions must "adequately inform[ ] the jury of the controlling legal principles without misleading or confusing the jury to the prejudice of the opposing party.").

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[15] Although the Court will grant the motion to exclude Mr. Taylor's legal opinions as discussed, the Court disagrees with OPTO's contention that his rebuttal report was untimely. The fact that OPTO chose not to offer an expert on the subject of its counterclaims, on which it bears the burden of proof, does not convert any proper Honeywell expert testimony on those claims into an "affirmative" rather than a "rebuttal" report. *See Hynix Semiconductor v. Rambus*, 2008 U.S. Dist. LEXIS 12195, at *16–17 (N.D. Cal. Feb. 3, 2008) (where a court "defined the rounds of expert disclosure based on which side had the burden of proof on an issue," a rebuttal report "does not have to 'rebut' another side's specific expert witness to be considered a 'rebuttal witness.'"); *see also FLOE Int'l Inc. v. Newmans'Mfg.*, 2006 U.S. Dist. LEXIS 97170, at *17–20 (D. Minn. Feb. 23, 2006) ("When the expert report disclosure deadlines are staggered, such that the party bearing the burden of proof is afforded the opportunity to provide an initial expert report, the party which does not bear the burden of proof can still submit an expert report in 'rebuttal,' even in the absence of an initial report produced by the party which bears the burden of proof, so long as it is within the established time frame set by the Scheduling Order.").

[16] OPTO does not challenge Mr. Taylor's expertise in patent law or patent transactions, and the Court does not mean to suggest by the exclusion of his testimony that he is in any manner unqualified in the areas he is expected to testify. Rather, as explained above, it is the role of the Court to instruct the jury on the relevant law, and it is improper for a "legal" witness to be called simply to offer his opinion as to which side should prevail in a contractual dispute.

[17] The Court is, of course, informed in that task by the parties' trial briefs and proposed jury instructions. However, the parties are not permitted to independently present testimony to the jury on the applicable law.

Therefore, expert testimony that merely reflects the expert's legal conclusions about disputed issues should be excluded. *See In re Zetia (Ezetimibe) Antitrust Litigation*, No. 2:18-md-2836, 2021 WL 6690337, at *2 (E.D. Va. Aug. 16, 2021). Testimony in the form of legal conclusions is not helpful to the jury because:

> it "supplies the jury with no information other than the witness's view of how the verdict should read." Determining when legal conclusions would be helpful to the jury must also take into account the role that the judge has in instructing the jury on the law. . . . [F]or example, [] when a witness gives opinion about the meaning of a specialized legal term, the witness is giving a legal conclusion that is better handled by the judge and, coming from the witness, will be of little assistance to the jury.

Merrill v. McCarthy, No. 7:14-cv-4, 2016 WL 1258472, at *2 (E.D.N.C. Mar. 30, 2016) (quoting *United States v. Offill*, 666 F.3d 168, 175 (4th Cir. 2011) (citations omitted) (alterations in original).

Indeed, Mr. Taylor's expert reports are indistinguishable from legal briefs. He describes in great detail his "understanding" of the governing law and facts (apparently mostly gleaned from Honeywell's counsel) then concludes on each point that Honeywell wins under his legal analysis. *See, e.g.*, Doc. No. 138-2 at ¶ 65 ("I disagree with OPTO's contentions concerning patent misuse on several grounds."). Such "testimony" does not "assist" the Court or the jury; rather, it supplants their primary roles in the trial (while also duplicating the role of counsel in closing argument). Accordingly, OPTO's motion will be granted and Mr. Taylor will not be permitted to testify as to his legal analysis or opinions as to either OPTO's alleged breach of contract or Honeywell's alleged patent misuse.[18]

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[18] Honeywell suggests that Mr. Taylor could assist the jury with information on the nature of patents and patent licensing agreements. To the extent that Mr. Taylor has expressed such views

2. Greg Adams

Plaintiffs have moved to strike and exclude the testimony of Greg Adams, an economist who OPTO intends to offer as an expert witness to testify "concerning the economic prong of OPTO's patent misuse counterclaim." Doc. No. 189 at 1. Dr. Adams holds degrees from Wake Forest University, the University of Maine-Orono, and the University of California at Berkeley, and has more than 20 years of experience in applied microeconomic analysis and consulting. *Id*. at 3. Honeywell does not challenge his qualifications. Rather, it seeks his exclusion based on the timing of the disclosure of sales information on which he relies, the discussions with OPTO's "consulting" expert that were identified in his expert report, and Honeywell's contention that he uses the incorrect standard for proving patent misuse in formulating his opinions. For the reasons discussed below, the Court will deny the motion.

Plaintiffs' first argument is that Dr. Adams relies on OPTO sales records and market-share information that was not timely produced in discovery. In response, OPTO represents that although the data was not produced in the same form as presented by Dr. Adams, Honeywell had access to the relevant numbers during discovery or soon after they were made available to OPTO. *Id*. at 2. At oral argument, the parties continued to dispute the nature and timing of OPTO's disclosures. The Court observes that while Plaintiffs are entitled to receive timely disclosures, Plaintiffs are not entitled to disclosure of information organized in the same manner as Defendant's expert; instead, they are only entitled to the underlying data. Further, without a far more detailed review of documents that are not currently in the record, the Court cannot make a factual determination of

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in discovery, the Court will consider permitting him to testify on general background or other specific information that may be helpful to the jury so long as he very carefully refrains from any testimony related to his legal analysis of the Agreement or the parties' legal disputes.

where the full truth lies with respect to what was disclosed and when it was disclosed (although it suspects given the history of the discovery disputes among the parties that there may be evidence supporting both positions). In any event, the Court is persuaded that the timing of the report and nature of the information is such that any alleged "failure was substantially justified or is harmless." *See* Fed. R. Civ. P. 37(c)(1); *Bresler v. Wilmington Tr. Co.*, 855 F.3d 178, 190 (4th Cir. 2017). Honeywell can effectively cure any "surprise," the trial will not be disrupted, the evidence may be important and OPTO's explanation supports allowing the testimony. *See id*. Therefore, the Court will not exclude Dr. Adams' testimony on the basis of the untimely disclosure of information.

Second, Honeywell complains that Dr. Adams relies on conversations with Mr. Sprague Ackley, another "expert in bar code technology and related AIDC fields," even though OPTO never identified Mr. Ackley as a fact or expert witness. Mr. Ackley is a consulting, non-testifying expert retained by OPTO to help OPTO's counsel better understand various technology and market issues, but OPTO was under no obligation to disclose Mr. Ackley independent of Dr. Adams' report. *See* Fed. R. Civ. P. 26(a)(2)(A) ("In addition to the disclosures required by Rule 26(a)(1), a party must disclose to the other parties the identity of any witness it may use at trial to present evidence"); 26(b)(4)(D) ("Ordinarily, a party may not, by interrogatories or deposition, discover facts known or opinions held by an expert who has been retained or specially employed by another party in anticipation of litigation or to prepare for trial and who is not expected to be called as a witness at trial.").

Dr. Adams was entitled to speak to Mr. Ackley as part of forming his opinions (as he would be to consult a treatise, document or any other bit of authority or evidence). And, because Dr.

Adams considered his conversations with Mr. Ackley in forming his opinions, OPTO was required to disclose that information, Fed. R. Civ. P. 26(a)(2)(B), and did so properly. Therefore, the Court finds no reason to exclude Dr. Adams testimony based on his talking with Mr. Ackley or any inadequate disclosure of Mr. Ackley's role with respect to Dr. Adams' opinions.

At oral argument, Honeywell argued that Dr. Adams could not serve as a "mouthpiece" for Mr. Ackley. OPTO does not disagree (as a general matter), but denies that Dr. Adams intends to merely parrot the views of a different expert. This risk of improper testimony appears low and can easily be monitored by the Court. Honeywell has an opportunity at Dr. Adams' deposition and on cross-examination at trial to explore with Dr. Adams his conversations with Mr. Ackley and how he relies on those discussions in reaching his opinions. Further, because the patent misuse claim will be tried to the Court rather than the jury, the Court can and will consider how much of Dr. Adams' testimony reflects his own opinions rather than others' and take that into account in deciding how much weight to give to his testimony. In sum, the Court finds no reason to exclude Dr. Adams testimony because of his discussions with Mr. Ackley.

Finally, Honeywell contends that the Court should exclude Dr. Adams' opinions under its *Daubert* "gatekeeping" role because he allegedly "applies the wrong legal test." Doc. No. 175 at 5. As noted above, the claim of patent misuse will be – at least in so far as experts are concerned – solely tried to (and decided by) the Court. Suffice it to say the parties disagree on the particulars of the relevant legal tests and how they have been applied by Dr. Adams. Because the Court will have a full opportunity to consider Dr. Adams' testimony in light of its determination of the governing legal standards and accord it such weight as it finds appropriate, the Court will also reject this objection.

Under Federal Rule of Evidence 702, "[a] district court considering the admissibility of expert testimony exercises a gate-keeping function to assess whether the proffered evidence is sufficiently reliable and relevant." *Westberry v. Gislaved Gummi AB*, 178 F.3d 257, 261 (4th Cir. 1999). "Relevant evidence, of course, is evidence that helps 'the trier of fact to understand the evidence or to determine a fact in issue.'" *Nease v. Ford Motor Co*., 848 F.3d 219, 229 (4th Cir. 2017) (quoting *Daubert v. Merrell Dow Pharm., Inc*., 509 U.S. 579, 591 (1993)). "Rule 702 was intended to liberalize the introduction of relevant expert evidence." *Westberry*, 178 F.3d at 261 (citing *Cavallo v. Star Enter.*, 100 F.3d 1150, 1158-59 (4th Cir. 1996)). Therefore, the court "need not determine that the expert testimony ... is irrefutable or certainly correct.... As with all other admissible evidence, expert testimony is subject to being tested by '[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof.' " *Id.* (citation omitted) (quoting *Daubert*, 509 U.S. at 596).

Although Rule 702 applies in bench trials, "the Court has increased discretion in how to perform its gatekeeping role." *Acosta v. Vinoskey*, 310 F. Supp. 3d 662, 667 (W.D. Va. 2018). The thrust of Rule 702 is to protect the jury from "evidence that is unreliable for reasons they may have difficulty understanding." *Quality Plus Servs., Inc. v. Nat'l Union Fire Ins. Co. of Pittsburgh, PA.*, No. 3:18-cv-454, 2020 WL 239598, at *13 (E.D. Va. Jan. 15, 2020) (quoting 29 Charles A. Wright & Victor J. Gold, *Federal Practice and Procedure* § 6270 (2d ed. 2019)); *see also In re Zurn Pex Plumbing Prods. Liab. Litig.*, 644 F.3d 604, 613 (8th Cir. 2011) ("The main purpose of *Daubert* exclusion is to protect juries from being swayed by dubious testimony."). However, when the judge serves as the decisionmaker, this risk of confusion presents significantly less of a concern, if any at all. *See United States v. Brown*, 415 F.3d 1257, 1269 (11th Cir. 2005) ("There

is less need for the gatekeeper to keep the gate when the gatekeeper is keeping the gate only for himself.").

Thus, the Court has discretion to admit the expert evidence "subject to the ability later to exclude it or disregard it" at trial. *Hewett v. City of King*, 2014 WL 7642093, at *1 (M.D.N.C. Sept. 8, 2014) (quotation omitted); *see also Pender v. Bank of Am. Corp.*, 2016 WL 6133850, at *3 (W.D.N.C. Oct. 20, 2016) ("As this is a bench trial, the Court can freely accept or reject an expert's testimony at trial as the trier of fact."); *In re Salem*, 465 F.3d 767, 777 (7th Cir. 2006) ("[W]here the factfinder and the gatekeeper are the same, the court does not err in admitting the evidence subject to the ability later to exclude it or disregard it if it turns out not to meet the standard of reliability established by Rule 702.").

The Court understands that Dr. Adams will testify in accordance with his / OPTO's understanding of the relevant legal tests. In turn, the Court expects Honeywell to vigorously challenge the relevance and weight of his testimony. In light of the discretion afforded the Court by a bench trial on the claim of patent misuse, the Court will not decide Honeywell's "legal standard" objections and arguments at this time. Instead, the Court will deny Honeywell's motion to exclude Dr. Adams, allowing him to testify and deferring a final ruling on the admissibility and weight to give his testimony until it can evaluate it at trial.

C. Remaining Discovery Disputes

In its recent Order, Doc. No. 154, ruling on OPTO's Objection to Magistrate Judge's Decision, Doc. No. 125, the Court deferred its decision as to two discovery disputes related to a "litigation loss contingency" included by OPTO's independent auditor in the company's financial statements. Honeywell based its discovery requests related to this information on discovery

requests made by OPTO in connection with the sales audit undertaken pursuant to Section 5.1 of the Agreement, which is discussed at length above. *See* Doc. No. 148 at 11. Having now ruled that the audit was untimely (and granting summary judgment on the related claim), the primary basis for Honeywell's discovery of OPTO's communications with its auditor has been negated. Thus, the discovery dispute has become moot. And, in any event, the Court would allow the objections as the requests appear to directly seek to discover OPTO's counsel's opinions of the case without any substantial basis.

Issue 6: **Attorney Communications and Documents Related to OPTO's Independent Auditor's Statements About this Litigation**

Honeywell seeks documents related to a litigation loss contingency (in the amount of Honeywell's litigation demand of $5.3 million), which was included in one of OPTO's public audits in Japan. Specifically, Honeywell seeks the following:

> [T]he public audit report specifically identifies several categories of documents the auditor relied on: (1) the complaint, the documents that form the basis of the lawsuit, and records of consultations with attorneys; (2) Board of Director meetings and other documents to examine the appropriateness of estimated amounts; (3) the views of legal counsel; and (4) the amount of the provision for litigation losses was reviewed by comparison and the like against the evidentiary documents.

According to OPTO, Honeywell has the public audit report along with all non-privileged communications with the auditors. However, it objects to producing attorney prepared evaluations of the case, which it contends are privileged. *See United States v. Deloitte LLP*, 610 F.3d 129, 143 (D.C. Cir. 2010) (finding that documents need not be produced where party has not proffered any good reason for wanting the documents other than its desire to know what the opposing party's counsel thought about the case). In response, Honeywell relies on the Court's earlier finding that

attorney communications related to the independent sales audit that was conducted under the Agreement are relevant and not privileged.

As noted above, the Court has ruled that the sales audit was untimely and thus irrelevant to Honeywell's remaining claims. This makes the "reciprocal discovery" grounds for Honeywell seeking this information no longer applicable. Therefore, the Court finds this discovery dispute is moot and will allow the objection and hold that OPTO need not produce the requested documents.

Also, the Court would allow the objection even if the issue was not moot. Although the full scope of the waiver of the attorney-client privilege in the context of communications with independent outside auditors is uncertain, most courts have found that disclosing attorney work product to an independent auditor does not constitute a waiver. *See United States v. Deloitte LLP*, 610 F.3d 129, 139–40 (D.C. Cir. 2010) (collecting cases). Here, as in *Deloitte*, it appears that the documents and information are being requested simply to reveal OPTO's counsel's evaluation of the case. Accordingly, the Court will not order the production of the requested information, which directly seeks opposing counsel's analysis of this litigation.

Issue 8: The Deposition of Mr. Tanaka

OPTO designated Mr. Tanaka as a 30(b)(6) deponent to testify as to the corporation's knowledge of the Agreement and the underlying litigations. Thus, his deposition is tied to the issue of the production of additional information with respect to the litigation loss contingency described in Issue No. 6. *See* Doc. No. 149 at 14. For the same reasons discussed above, the Court will allow the objection as to this discovery request and hold that Mr. Tanaka need not testify on the topic of the litigation loss contingency.

IV. ORDER

NOW THEREFORE IT IS ORDERED THAT:

1. Plaintiffs' Motion for Partial Summary Judgment (Doc. No. 116) is **GRANTED** as to the construction of Section 1.4 of the Agreement but **DENIED** as to their claims under Section 5.1. Summary judgment is entered in favor of Defendant on Plaintiffs' "Section 5.1" breach of representation and warranty claim;
2. Defendant's Motion for Summary Judgment (Doc. No. 132) is **DENIED**, except as described above;
3. The parties' cross Motions for Summary Judgment on Defendant's Patent Misuse Counterclaim (Doc. Nos. 161, 168) are **DENIED**;
4. Defendant's Motion to Strike (Doc. No. 137) is **GRANTED** to the extent described above;
5. Plaintiffs' Motion to Strike (Doc. No. 173) is **DENIED**;
6. Defendant's Objections to Issues 6 and 8 of the Magistrate Judge's ruling on discovery disputes (Doc. Nos. 115, 125) are **ALLOWED** as described above; and
7. This case shall proceed to trial on the merits of the remaining claims in the absence of a voluntary resolution of the dispute among the parties.

SO ORDERED ADJUDGED AND DECREED.

Signed: April 20, 2023

Kenneth D. Bell
United States District Judge